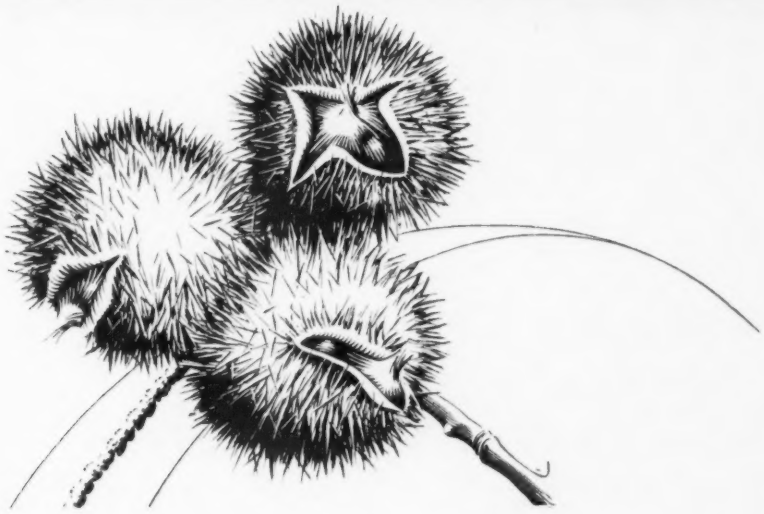
4 AUGUST 1961

METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS



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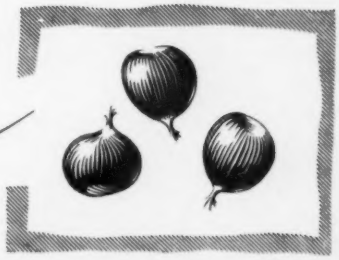

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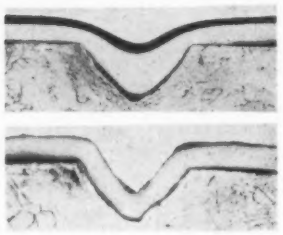

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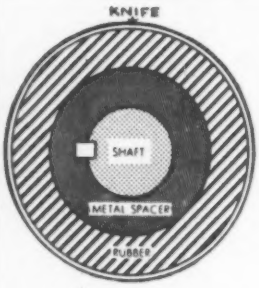

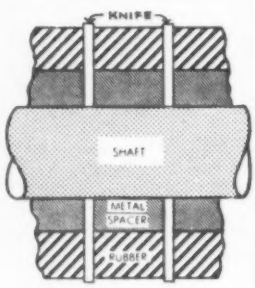

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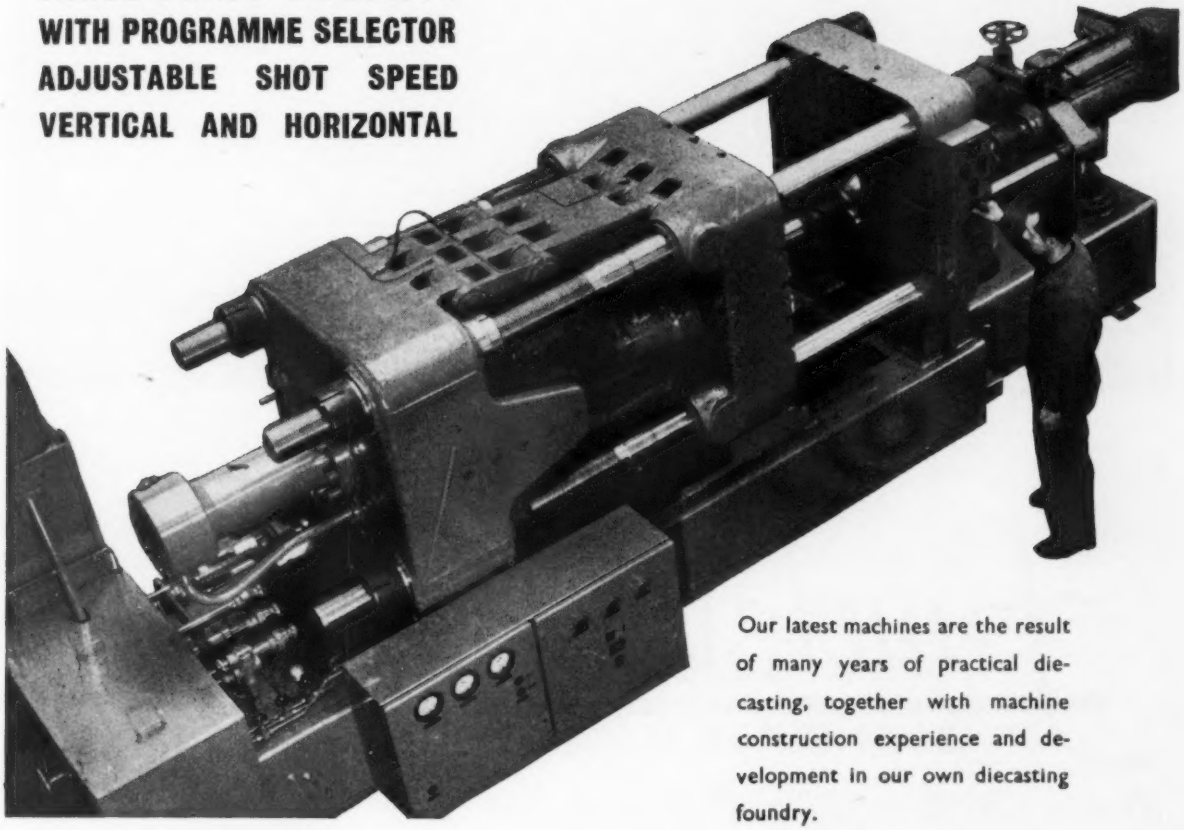

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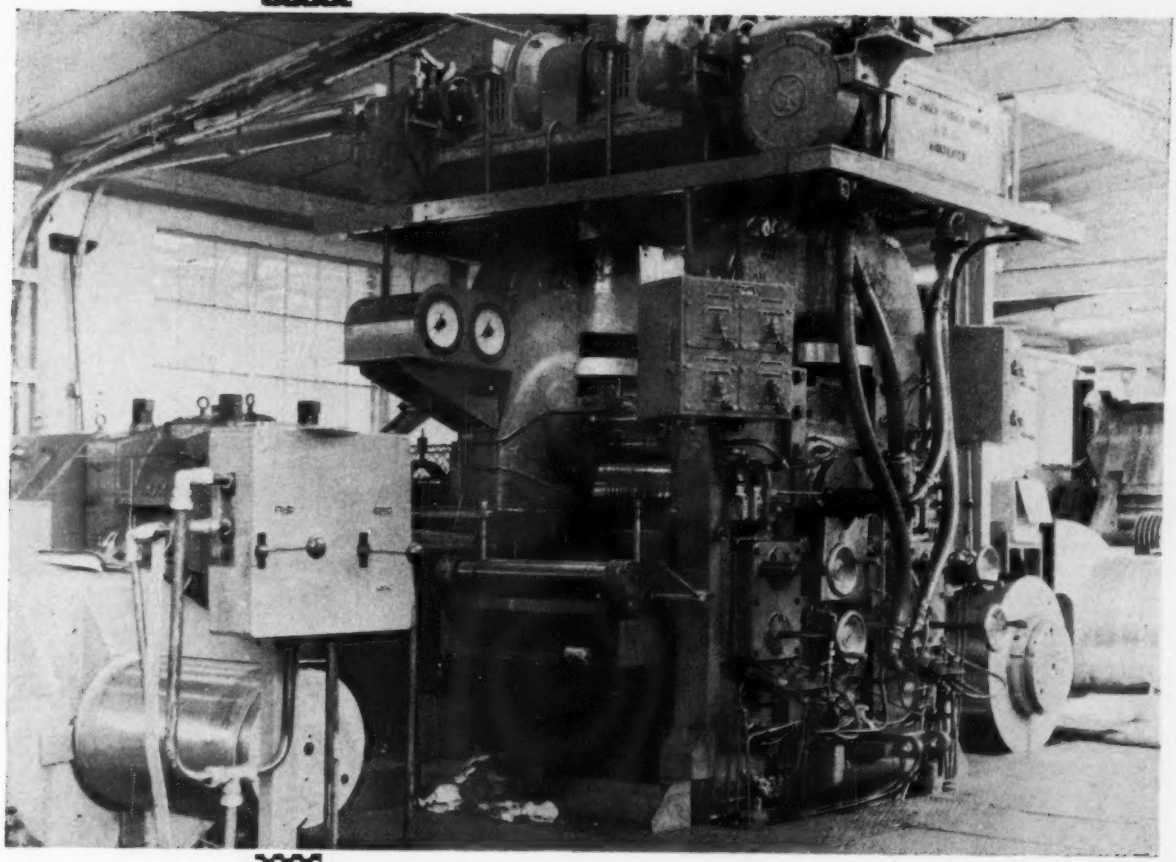

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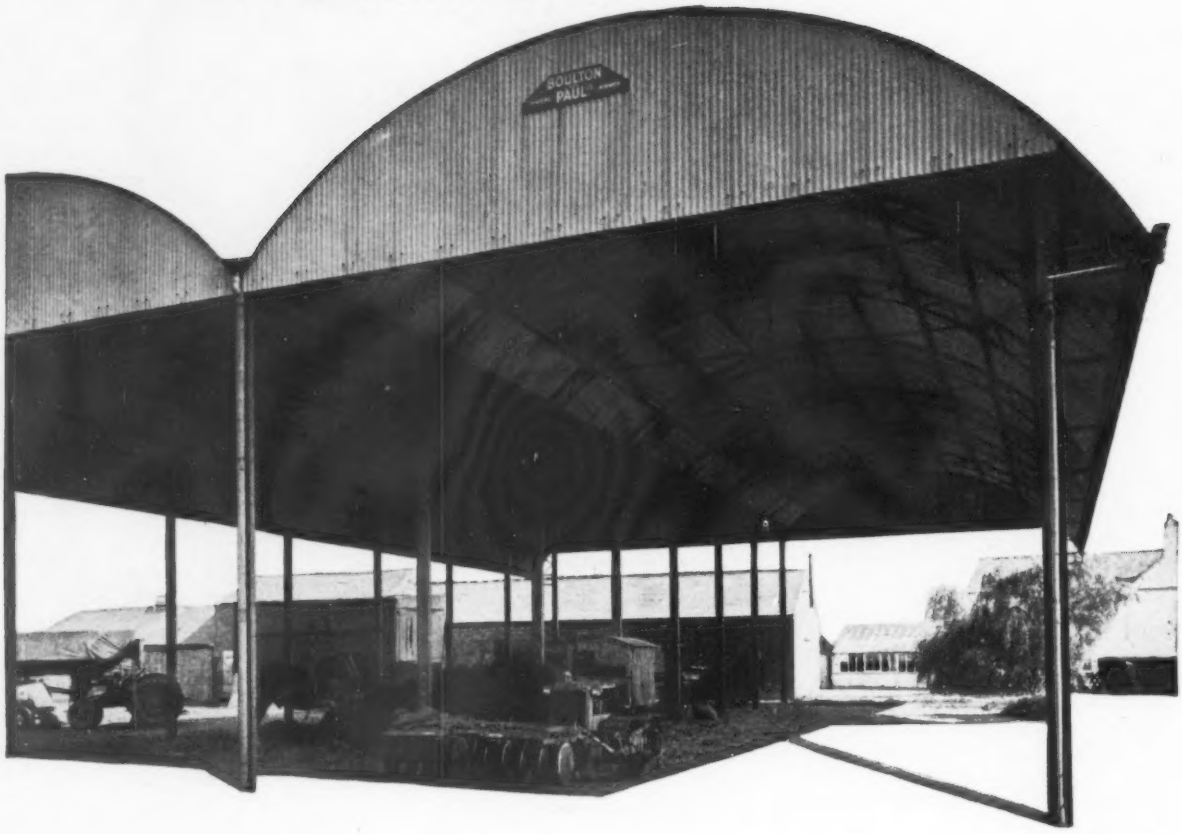

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Dangerous Stagnation

WHAT are the real reasons for British firms failing to export? A pilot scale study of the attitude to exporting of fifty-two firms—all with less than 300 employees—carried out on behalf of the Institute of Directors attempts to provide the answers. The survey was confined to smaller firms—half of them manufacturers of engineering products—because it was felt that it was among these that the greatest expansion of exports was possible. Of the firms surveyed about 25 per cent were exporting vigorously; the exports of 50 per cent were declining or stationary at a low level; and just under 25 per cent had never exported and were not really interested in doing so.

Among the reasons advanced by the non-exporting firms are inadequacy of information, vagueness of the availability of Government facilities, financial risks, high taxation rates and lack of financial incentives, the complexity of the forms involved, the difficulties of dealing with foreign languages, and the effect of big demand on the home market. The highly specialized nature of their products, and the fact that they sell to other manufacturing firms are given as reasons why a number of engineering firms making component parts do not export direct.

The fallacy of this type of reasoning is exposed by the keen exporters, who are quite positive that it is not difficult to get adequate information, that Government facilities are helpful, that the factor of financial risk is not a real obstacle to exporting, and that language is no barrier to trade. With regard to the manufacturers of engineering components, there would seem to be no very good reasons why they should not be able to develop an export operation, if they want to.

In most cases, says the Report, the manufacturer's failure to export successfully "is a function not of any external circumstances, but of his general attitude towards exports; it is not that he *cannot* export, but simply that he does not want to". Many tend to lack confidence in their ability to capture and sell in overseas markets. A fair number of those interviewed were diffident about the success of the export drive, and look on competitors such as Germany not with any idea of emulation but with resignation at their seizure of former British markets. Their attitude to new overseas markets is not adventurous, and many inquiries which come to the firm are ignored, or summarily dismissed as impossible.

"While it is unlikely that the future of British export trade will lie with these firms", the Report comments, "it is still clear that a large number of firms which are working in the home market at a reasonable level of efficiency could well improve their own position by proper attention to exports." If, through the findings of this study, the national effort in the export field can be made only a fraction more efficient, it will not have been carried out in vain.

Continuous Casting of Aluminium Alloys

By W. M. Doyle, Ph.D., M.Eng., F.I.M.
(Research Division, High Duty Alloys Ltd., Slough)

ALL the important major developments in the continuous, or semi-continuous casting, of aluminium and its alloys have occurred during the past 25 years. Before World War II, ingots or billets for rolling, forging or extrusion were made either in solid, cast-iron book-moulds or in thin, welded, sheet-steel canisters, cooled by a very vigorous and controlled flow of water around the annular space between the canister and a separate outer container. The introduction of vertical continuous casting, or direct chill casting as it is sometimes called, has resulted in a vast improvement in ingot quality for subsequent fabrication and in economies in metal loss due to the reduction of the percentage of the top and bottom cropping and the depth of machining of the as-cast surface.

It is proposed to deal, in the first instance, with the basic aspects of the production of good quality, high strength, aluminium alloy ingots by the vertical, fixed mould, direct chill casting process, which is used for producing solid round, or hollow, ingots up to 36 in. diameter and rectangular rolling slabs up to about 40 in × 10 in. section.

Ingot and Slab Production

The production of solid round, or hollow, ingots and rectangular rolling slabs in a wide variety of sizes for subsequent fabrication by forging, or extrusion and rolling, respectively, in the whole range of aluminium alloys from commercially pure up to the high strength alloys, is now practically universally carried out by the vertical continuous, or semi-continuous, direct-chill casting process. This method, which involves the use of a fixed, or reciprocating, shallow die or mould, has attained general use since the last war and every foundry has its own particular design for the engineering side of the installation. In brief, the prepared and de-gassed metal from a holding furnace is poured down a launder, with minimum turbulence, and over a distributor, or baffle-plate, so that the metal is distributed over the top surface of the still molten metal in the mould. The latter is a cylindrical or rectangular box in aluminium or copper alloy, open at both ends, and cooled by circulating water in an annular space around the mould or by separate cooling sprays.

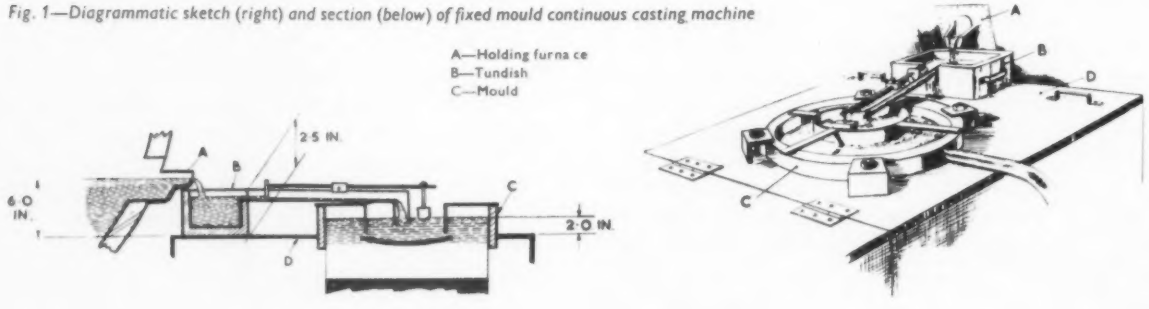
A sketch and diagrammatic section of the arrangements for pouring a 15½ in. diameter ingot in high strength aluminium alloys at the Forgings Division of High Duty Alloys Ltd. are given in Fig. 1. The molten metal from the holding furnace, *A*, is poured into a refractory-lined tundish, *B*, where the level is automatically controlled by a device which is based on the capacitance of the condenser formed by a predetermined air-gap between a metal plate and the top of the liquid metal in the tundish. This arrangement can be clearly seen in Fig. 2. The device is really a test condenser in a capacitance bridge and the signals resulting from out-of-balance conditions are linked electronically with the hydraulic valve operating the tilt of the holding furnace. The flow of metal from the tundish down the launder is controlled by a very simple but effective float and choke arrangement. If the level of the metal in the mould, *C*, rises then the float is raised and the triangular choke impedes the flow of metal down the launder. Fig. 2 also illustrates the fact that these control devices are equally effective when multiple ingots are poured at the same time.

To minimize friction between the ingot and the mould wall, the latter is lubricated by means of a mixture of tallow and mineral grease, or graphite and rape-seed oil, or proprietary greases, and the operator usually has a predilection towards his own formulation. This lubrication, however, is important if rupture of the ingot or break-through of the molten metal in the core is to be prevented. To overcome the potential difficulties due to incipient rupture of the ingot skin, the Junghans machine incorporates an oscillating mould which permits minor ruptures to be re-frozen and contract away from the mould wall.

Before casting commences, the base of the mould is sealed with a plate or plug extending a short distance up the die. The plug is attached to the top end of a hydraulic ram or a mechanical device which is rigidly supported vertically over its whole length of travel and can be controlled to descend at a constant speed over the range of about 1 to 8 in/min. The plate, or plug, is withdrawn from the base of the mould, together with the growing ingot, which is directly cooled by water sprays. Some designs involve the retention of a fixed depth of water in the tank.

In the truly continuous casting process, a flying saw is automatically attached to the descending billet and the required lengths are cut off as they are cast. As this requires a large supply of molten metal, most operators use a semi-continuous casting process in which the casting is interrupted, the mould moved away and the billet pushed up and removed. It is subse-

Fig. 1—Diagrammatic sketch (right) and section (below) of fixed mould continuous casting machine



In this article, the substance of which formed the basis of a lecture given before the Liverpool Metallurgical Society earlier this year, the author reviews the principal methods in use for the production of continuously cast ingot rod and strip in aluminium alloys. Several types of machine are discussed and the differences between them emphasized.

quently sawn into the required lengths and scalped, when necessary, before working.

Some typical production casting speeds and cooling water rates for a selection of solid round aluminium alloy ingots are shown in Table I. The casting speeds for the commercially pure grades of aluminium, 1A, 1B and 1C, may be higher than those given in the Table, but practical considerations limit the speeds used under production conditions, especially when multiple, small diameter ingots are being cast on the same machine. Relatively high speeds are used for alloys with a short freezing range, such as the sodium-modified eutectic type aluminium-silicon alloy D.T.D.324. The high strength aluminium-zinc-magnesium-copper alloys, typified by the generic specifications D.T.D.683 and 363, are cast at the slowest speeds.

By the removal of heat through the mould walls, a chilled layer of solid metal just over $\frac{1}{2}$ in. thick is produced on the sides. This outer skin functions as a chill mould for the liquid core until complete solidification takes place by means of the cooling effected by the water sprays directed downwards over the surfaces of the ingot.

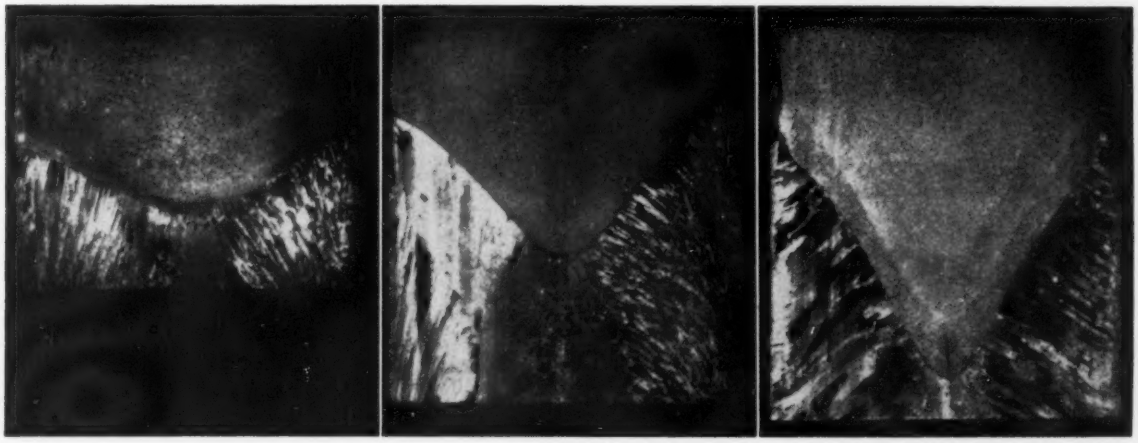
The shape of the solidification front,[1] as the casting speed of a 9 in. diameter ingot in commercially pure aluminium was increased from 3 to 7 in/min. is shown in Fig. 3. It will be noticed that there is a tendency for a thinning of

Fig. 2—Multiple pouring of high strength ingots showing control devices. Launders carry the metal from the refractory-lined tundish (right) into the mould. The float and choke arrangement for controlling the flow can be clearly seen

TABLE I—TYPICAL CASTING SPEEDS IN IN/MIN.

Alloy	Ingot Diameter						Pouring Temperature (°C.)
	5 in.	7 in.	9 in.	12 in.	16 in.	20 in.	
1A, 1B, 1C	5	4	4	3	$2\frac{1}{2}$	2	700-710
N3, N4, N5, N6	4	3	3	2	$1\frac{3}{4}$	$1\frac{1}{2}$	700-710
H.12, H.14, H.15, H.18	4	3	3	2	$1\frac{3}{4}$	$1\frac{1}{2}$	700-710
D.T.D.324	—	4	4	3	$2\frac{1}{4}$	2	645-660
D.T.D.683/ D.T.D.363	$3\frac{1}{2}$	$2\frac{3}{4}$	$2\frac{1}{2}$	2	$1\frac{1}{2}$	$1\frac{1}{4}$	700-710
Water Rate (gal/min.)	$12\frac{1}{2}$	17	20	30	50	80	

Fig. 3—Effect on the solidification front, as the casting speed of a 9 in. diameter ingot is increased from 3 to 7 in/min.



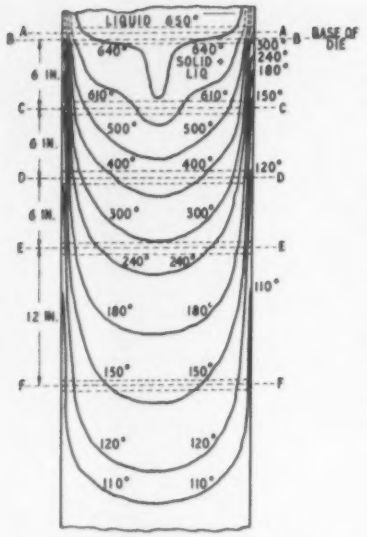


Fig. 4—Isotherms in a 16 in. diameter ingot poured at 3½ in/min.

the solid outer skin near the base of the mould, and this is attributed to the reduction in heat transfer due to the air-gap forming between the mould wall and the metal shrinking away from it. Theoretically, it should be possible to reduce the length of the mould and rely on the cooling of the sprays but, in practice, a certain latitude has to be given in the maintenance of the liquid metal level. However, the very effective dielectric device, shown in Fig. 2, which has been developed at H.D.A. Forgings Division, maintains the metal level constant.

The isotherms existing in the continuous casting of a 16 in. diameter Hiduminium R.R.56 alloy ingot, cast at the relatively high speed of 3½ in/min., were investigated some years ago and the heat flow from the ingot at various stages in the process was assessed.[2] These isotherms are shown in Fig. 4 and it was found that about 18 per cent of the original heat content of the metal is removed in the mould and a further 38 per cent by the direct chilling of the sprays during transit through the first 6 in. below the mould.

The temperature gradients shown in Fig. 4 result in serious stress concentrations which may, in the case of certain high strength alloys, result in cracking of the ingot. Briefly, the stress distribution is compression in the outer layers and tension near the centre. The hoop and longitudinal stress sum has been measured, by the X-ray back reflection technique, as high as 20·8 tons/in^2 near the surface, and the tensile stress sum near the centre of a 4⅛ in. diameter ingot in Hiduminium R.R.59 at 10·5 tons/in^2. The internal stress and the cracking tendency may be reduced by increasing the mould length, but at a sacrifice in ingot quality. High casting speeds and fluctuations in the speed during the casting produce a greater tendency to cracking.

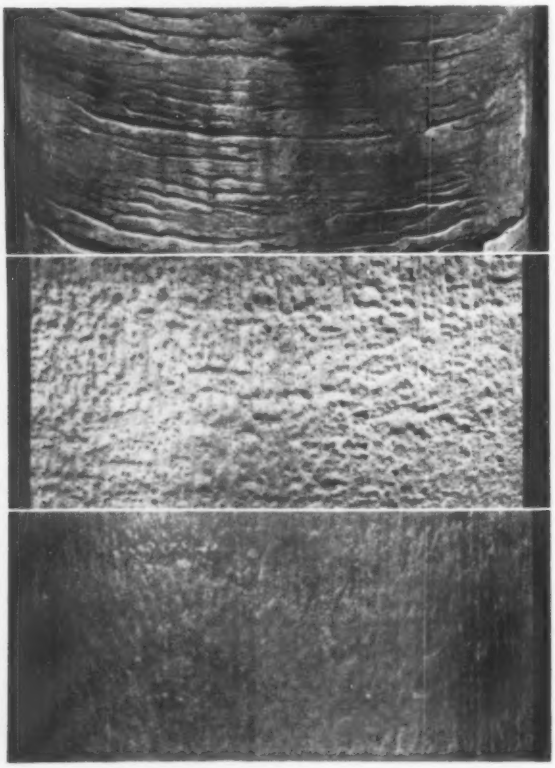
Cold Shuts

Some of the defects occasionally encountered on the surface of continuous cast ingots are shown in Fig. 5, and Fig. 5a illustrates the helical rippling effect of cold shuts. These usually occur at slow speeds, due to the surface tension of the liquid metal forming folds over the top of the already solid metal near the mould wall. In the case of ingots with this defect, it is necessary to remove an excessive and uneconomical amount of metal from the surface in order to clear the effects of underlying local coarse segregates of eutectic.

For good quality sheet, rolling slabs must be scalped to remove all the surface defects, together with the areas of segregated constituents usually found below these defects, sometimes to a depth of ½ in. Irmann[3] has suggested that cold shuts may be prevented by the use of a longitudinally grooved mould. The grooves are about 0·008 in. deep and about 0·020 in. apart.

Segregation

During the solidification of alloys with a wide freezing range, such as the high strength aluminium-zinc-magnesium-copper and aluminium-copper-magnesium alloys, there is a tendency towards inverse segregation which may lead to exuded beads or "blebs" occurring on the surface of the ingots. These are distributed all over the surface and are caused by insufficient cooling. A typical appearance is shown in Fig. 5b. They are more obvious if long moulds are used in the casting, as a long air-gap allows the skin to be reheated above the solidus and the low melting-point constituents to be forced outwards by volume expansion. These eventually exude through the surface in the form of globules. It has been shown[2] that the outer ⅛ in. of the surface skin of a rolling slab contained 9·09 per cent copper, 1·80 per cent mag-



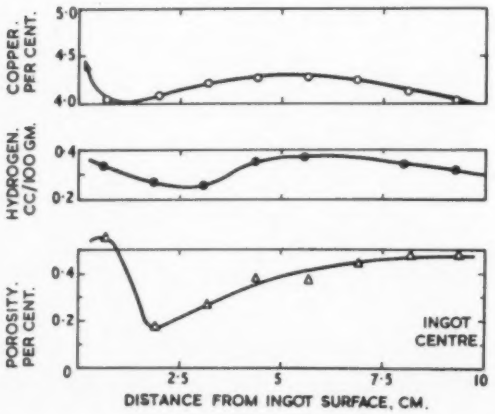
Left: Fig. 5—Top; Cold shuts. Centre; Surface exudation. Bottom; Good average surface

(*a*)

(*b*)

(*c*)

Fig. 6—Segregation and porosity in large rolling slab, after Ransley and Talbot



nesium and 0·61 per cent iron, compared with an average composition in the ingot of 4·29 per cent copper, 1·04 per cent magnesium and 0·32 per cent iron. The highly alloyed alloy ingots of aluminium, especially in the larger sizes, are never entirely free from surface exudations (Fig. 5c), because, if too short a mould is used and excessive cooling applied, cracking will occur due to the internal stresses.

Internal Soundness

The slight porosity sometimes found near the centre of large ingots is due to normal shrinkage arising from the lower efficiency of the chilling process under these conditions, but a similar defect, near the outer periphery may be caused by gas porosity. The latter has been studied by Ransley and Talbot,[4] who have shown that in large rolling slabs (30 in × 8 in.) in an aluminium-copper-magnesium alloy, there is the tendency for a zone of gas porosity to occur approximately 1 in. from the ingot surface. This is in the region which has been remelted after the air-gap has formed. There is also a tendency for copper to segregate in parallel with hydrogen, as shown in Fig. 6, due to the gas concentration in the lower melting-point residual liquid. However, under the rapid freezing conditions which exist in the continuous casting process practically 100 per cent of the gas content is retained in solid solution.

References

1 D. M. Lewis and J. Savage; *Met. Rev.*, 1956 **1**, (1), 65.
2 W. M. Doyle; *Met. Ind.*, 1945, **66**, 370, 390.
3 R. Irmann; *Giesserei*, 1952, **39**, 393.
4 C. E. Ransley and D. E. J. Talbot; *Z. Metallkunde*, 1955, **46**, 328.

(To be continued)

Standard Specifications

Notched Bar Tests: Part 1, *The Izod Impact Test on Metals.* (*B.S.*131: *Part* 1: 1961.) *Price* 6*s.*

DEALING with the Izod impact test on metals, this standard is published as Part 1 of a revision of B.S.131. (Part 2, published in 1959, deals with the Charpy V-notch test.) The scope of the standard has been widened to include details of the method of test with structural and dimensional requirements for the testing machine.

Whereas the former edition of the standard gave only nominal dimensions of test pieces, the new edition gives dimensions with appropriate machining tolerances.

The tolerances for ferrous test pieces are in accordance with a recommendation of the International Organization for Standardization, but for non-ferrous metals a more restrictive tolerance has been applied to the dimensions of the test piece. The structural and dimensional aspects of the testing machine are fully dealt with, and an appendix gives recommendations for its installation.

Electroplated Coatings on Threaded Components. Part 1: *Cadmium on Steel Components; Part* 2: *Zinc on Steel Components.* (*B.S.*3382: *Parts* 1 *and* 2: 1961.) *Price* 7*s.* 6*d.*

COVERING the plating of small threaded components such as bolts, screws and nuts, Parts 1 and 2 of this new standard have been published, as one booklet (B.S.3382: Parts 1 and 2). They deal with thicknesses of plating which, without preventing the assembly of threaded components, will ensure satisfactory protection against corrosion.

Introductory notes explain the problems associated with the electroplating of threaded components and the need for special procedures for thickness specification, inspection sampling and thickness determination.

As well as specifying plating thicknesses, sampling and other inspection procedures, and methods of thickness determination, this publication lays down requirements for the purity of the plating, for reduction of hydrogen embrittlement for finish and appearance of plated surfaces, and for passivation. In the case of cadmium plating, requirements are also laid down for adhesion and for freedom from gross porosity. Tables of surface areas of standard screws, bolts and nuts are given as a guide to electroplaters, so that they may estimate the conditions of current and plating time needed to obtain the required deposit thickness, and also to assist in the estimation of average thickness on plated components.

The plating thicknesses laid down are intended for components having threads of basic major diameters from 0·060 in. to $\frac{3}{4}$ in. inclusive, specified in B.S.84, 93, 811, 1580, 1095 and 2779. The publication refers, in particular, to the general purpose bolts, screws and nuts specified in B.S.57, 450, 1083, 1768, 1981 and 3155.

The plating thicknesses specified will be adequate for most purposes but under severe conditions, greater protection may be needed. In such cases, reference should be made to Part 7, B.S. 3382, to be published in due course under the title, "Thicker Plating for Steel Components". Other parts will deal with nickel and nickel/chromium on steel components, nickel and nickel/chromium on brass components, tin on brass components and silver on brass components.

Copies of the above-mentioned standards may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

Readers' Digest

CAREERS IN INDUSTRY

"Industry and Careers." *Edited by D. E. Wheatley. Published by Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.*1. *Pp.* 872. *Price* 55*s.*

PROVIDING a new and analytical treatment of the problem of choosing a career, this book gives first a full and detailed description of each industry and then—against this background, which is essential for a thorough understanding—it goes on to review the career prospects the industry offers. All industries are covered except those in which career opportunities are limited, and while the main emphasis is on careers leading to responsible positions, the book also covers trades and crafts.

The three opening sections deal with the philosophical background of the approach to starting a career, written by authorities experienced in advising young people. They cover such problems as whether a prospective entrant is likely to be suited to a particular type of work by reason of talent, temperament and inclination; and methods of selection and training for positions of higher responsibility. The last two sections of the book deal with advanced education and available scholarships.

In the main body of the book, each industry is thoroughly analysed: its size, location, organization and managerial structure; the materials, techniques and plant it uses, and its attitude towards research; its personnel at every level, their work and their skills. These sections, in fact, constitute a valuable textbook on the structure of British industries.

This detailed study of each industry is followed by a review of its career prospects: how it may be entered; what educational and other qualifications are necessary for advancement, and how they can be obtained; what training schemes, if any, there are for technologists and management.

To all faced with the problem of choosing their careers, whether university graduates or school leavers, and to appointment boards, career masters, youth employment officers, and all those, including parents, called upon to advise the young on this vital choice, this book should be of great value.

Obituary

Mr. E. L. Pipe

WE regret to record the death of Mr. E. L. Pipe, who represented F. W. Berk and Co. Ltd. in the foundry industry since 1946, especially in the Midlands, South Wales and the West. He joined the company in 1937.

OUT OF THE MELTING POT

Affected

EQUILIBRIUM diagrams of alloy systems obviously hold good exactly only where the alloys have attained equilibrium. In cases where equilibrium conditions are attained very slowly, alloys as produced and used in practice may have constitutions differing more or less appreciably from the state of affairs reached at equilibrium. A less frequently considered and also a much less explored factor capable of modifying conditions as shown in equilibrium diagrams is the pressure. An increase in pressure is known to raise the melting point of materials and to influence directly other phase changes involving changes in volume and, indirectly, other phase changes involving diffusion, which slows down at high pressures. Yet another factor which may affect the data incorporated in conventional equilibrium diagrams is the size of the specimen. As the size of the specimen is reduced, the effect of surface forces becomes relatively larger and may eventually extend throughout the bulk of the specimen with a definite effect on its "equilibrium" state. Size must necessarily also be taken into account in any two-phase systems: after all, the state of affairs in such a system is likely to change somewhat radically as and when the size of the specimen becomes equal to or less than the average size of the constituent phases. A particular size or dimensional effect is that of the thickness in the case of thin films. A good deal of study has been devoted to the way in which limited thickness affects the structural characteristics and with them the properties, e.g. electrical conductivity, of metal films. The way in which it affects the constitution of an alloy film has recently been investigated by electron diffraction examination of vacuum-deposited aluminium-copper alloy films with 0 to 30 per cent copper and a thickness of 250Å. An extension of the solid solubility of copper in aluminium—a reversible solid solubility of up to 18 per cent copper and metastable solutions with up to 25 per cent copper—was found to occur in these films. There was also a marked extension of the solid solubility of aluminium in the $CuAl_2$ phase. The other remarkable feature was the lowering of the eutectic temperature from 548° to 520°C.

Grounds for Grumbling

NOTHING is more destructive of the satisfaction being derived from grumbling on the comfortable basis of "why don't *they* do something about it" or "*something* ought to be done about it" than uncomfortably to have suggested that you yourself could do something about it. Furthermore, the satisfaction of habitual grumbling must be protected against the shock experienced when the grievance suddenly disappears. Consider, for example, what has happened to the habit of grumbling that *they* or *nobody* were sufficiently interested in applying new scientific discoveries and exploiting technical inventions and developments, when all of a sudden there are not enough discoveries, inventions, etc., to meet the demand, and even a bright idea of how to send a man to the moon would be welcomed. Decidedly, it is now preferable to grumble about the time it takes to put discoveries, etc., into practice.

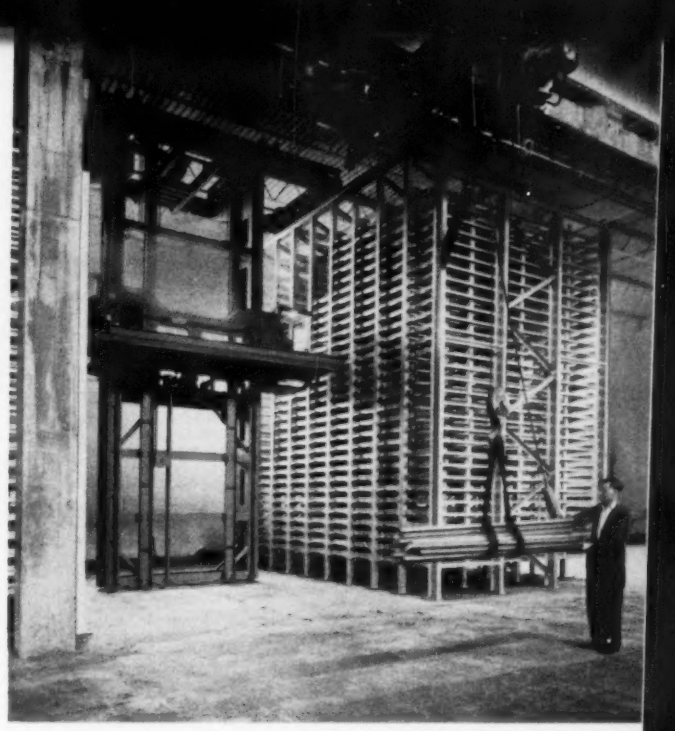
Easier

WHILE it has been reported that elsewhere work on the hydraulic extrusion of metals is continuing, work in this field at the Institute of Metal Physics of the Academy of Sciences of the U.S.S.R. by the team under B. I. Beresnev continues to be reported. It may be recalled that, in hydraulic extrusion, the extrusion billet in the container is surrounded by a suitable liquid, the leading end of the billet being shaped to fit the opening of the extrusion die to prevent escape of liquid from the container. In the absence of an extrusion ram, the pressure required to extrude the billet is applied to the billet through the liquid to which, in turn, pressure is applied by a working liquid from a compressor capable of generating pressures of the order of 10,000 kg/cm^2. A film of the extruding liquid passes through the die on the surface of the metal being extruded. The process appears to be particularly promising as a means of extruding steels and less ductile metals. Having during the past few years studied various aspects of the hydraulic extrusion process, and described the experimental technique and the results both in a series of Papers and in a book, Beresnev and his collaborators have more recently turned to the study of hydraulic extrusion at elevated temperatures as a possible means of reducing the pressures required and thus making the process more suited to practical application. The small experimental set-up was designed for working pressures up to 10,000 kg/cm^2, while provision was made for heating the container, the extruding liquid and the billet to temperatures up to 400°C. The experiments were made using aluminium of commercial purity. Knowing the reduction in strength of the metal with temperature, it was possible to calculate the corresponding reduction in extrusion pressure to be expected, assuming that conditions of flow would remain the same as at room temperature. In actual fact it was discovered that this expected reduction could be either exceeded or not attained, depending on the nature of the extruding liquid. This again emphasized the importance, previously observed at room temperature, of this liquid, though some of the effects, e.g. the beneficial effect of additions of oleic acid to transformer oil, were reversed at elevated temperatures. Though explanations for some of the observations are still lacking, some general directives in regard to composition of the liquid for extrusion at elevated temperatures have already emerged. As at room temperature, the effect of the liquid used on the surface finish and indeed, in some cases, on the continuity of the extruded products was again very much in evidence, the behaviour in this respect of different liquids differing, however, from that at room temperature.

Skimmer

New Brass Rod Mill

(*Concluded from* METAL INDUSTRY, 28 *July* 1961)



Storage racks in the new rod mill at United Non-Ferrous Metals Ltd. Material is loaded on to flat pallets, raised by the special lift (left centre) which feeds pallets into the horizontal compartments

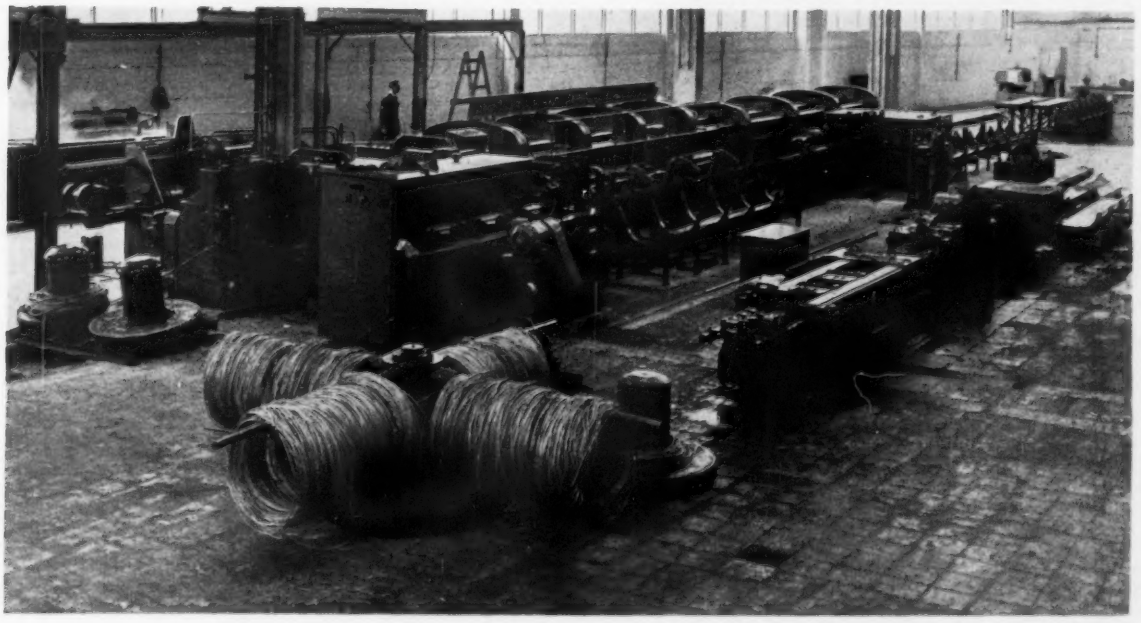
IN the rod mill associated with the new extrusion plant at the Adderley Street works of United Non-Ferrous Metals Ltd., a number of new items of equipment have been laid down to deal with the increased production from the press, including an unusually large nick and break machine, a Farmer Norton Hydrabench, and automatic drawbenches.

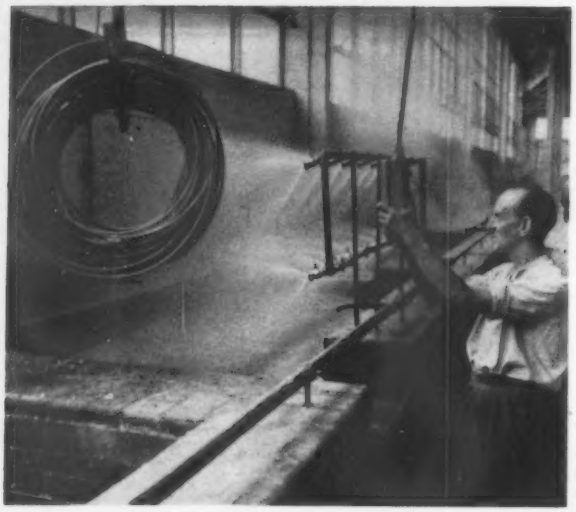
At the time of writing, one Schumag Type KZRP GR1 automatic drawbench has been installed; delivery of another similar type will take place shortly.

Designed to straighten, test and point coil stock for the Farmer Norton Hydrabench, the nick and break machine is capable of dealing with sizes in the round of up to 1½ in. dia. In normal operation, coils are loaded on to a horizontal block which, powered by a hydraulic push piston and cylinder, pushes the end of the coil into straightening rolls, which are then clamped pneumatically on to it. The rod is fed forward into the vice of the testing section of the machine which, pneumatically, grips and nicks the rod in one operation. A single stroke of the breaking head is then sufficient to fracture most of the rod alloys. After the fractured cross-section has been examined for defects—chiefly extrusion "pipe"—the final stage of the machine's operation occurs when the rod travels into a turning head under the combined influence of the horizontal block and the straightening rolls. Here, the 18 in. point required for the Hydrabench is cut.

Alongside the familiar Schumag machines, a prototype hydraulic drawbench of novel design, manufactured by Sir James Farmer Norton Co. Ltd., is sited. This impressive machine is capable of handling material in coil up to 1½ in. dia., or its equivalent in hexagon and squares, etc., whilst sizes of up to 2½ in. dia. or its equivalent may be drawn from straight lengths.

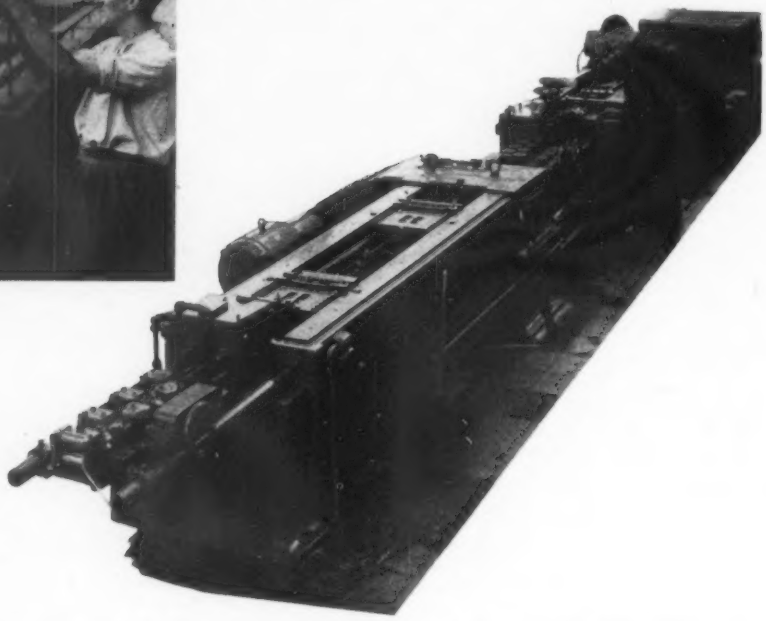
General view of the rod mill equipment; at the extreme left are the pickling tanks with the nick and break machine in front of them. Across the centre of the picture is the Hydrabench, and the Schumag drawbench on the right. At the rear right are the reeling machines and the cut-off saw





Foot-operated swill spray in the cold swill tank of the coil pickle line

Schumag KZRP GRI automatic drawbench. A second machine of this type is to be installed shortly



Basically, the Hydrabench consists of a double drawbench with two "dogs" powered by hydraulic cylinders operating in a reciprocating manner, and further coupled mechanically in such a way that the "power" stroke of one dog also provides the return motive power of the other. From the drawbench proper, drawn material may either be fed to straightening rolls, or a linisher, as desired. The latter is capable of finishing polished rod up to a diameter of 1½ in.

The equipment of this section of the new development is completed by two reelers, both supplied by Sir James Farmer Norton and Co., one for dealing with round bars of up to 2½ in. dia., the other up to 4 in. dia., and a cut-off saw manufactured by Ballinger Ltd. Two sets of pickling tanks of conventional design have also been installed, constructed by Prodorite Ltd. These are similar to others in the older portion of the works, which have always given satisfactory service. The cold swill tank of the coil pickle line is equipped with a simple swill spray operated by foot valves. This was designed within the company and has been found to be remarkably effective and at the same time conservative in its consumption of water.

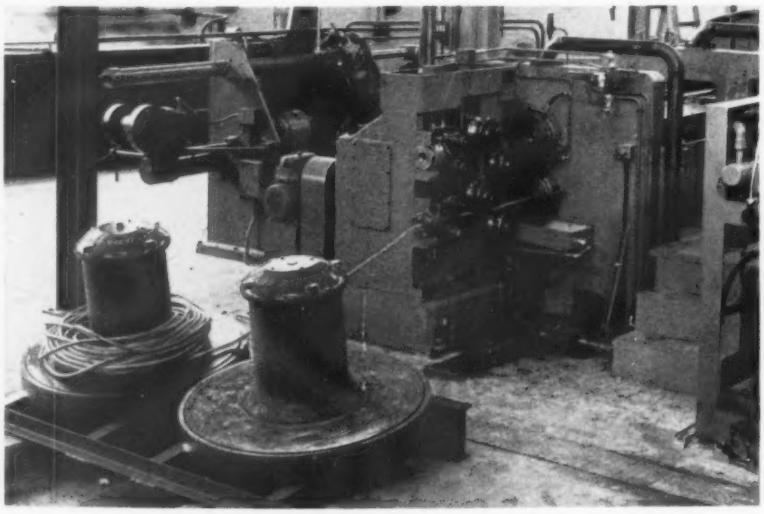
Warehouse and Stores

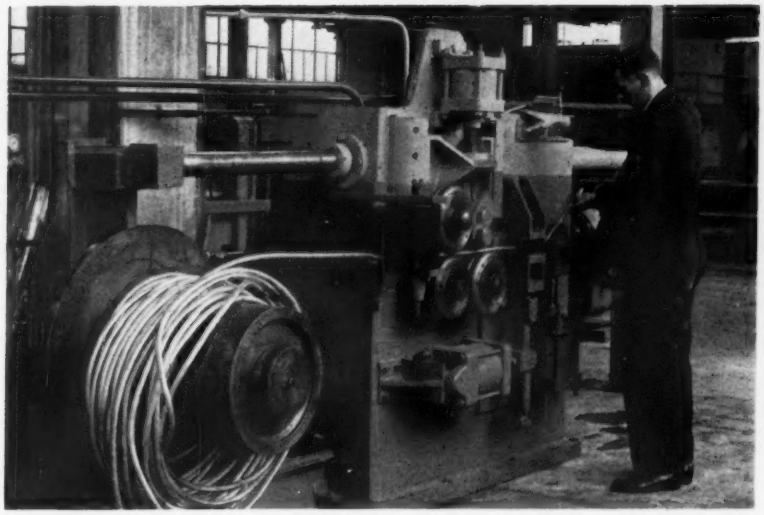
From the rod mill, material passes into an inspection, despatch and storage warehouse; here the methods employed for storage are worthy of note. A departure has been made from the conventional upright method employed in many rod mill stores in an effort to facilitate and simplify stock control and, at the same time, eliminate the "bowing" which frequently occurs with the smaller sized material.

Here material is stacked, horizontally, into flat pallets, each capable of holding one ton. Still in the horizontal position, they are loaded on to a storage crane of unique design, manufactured by Acrow (Engineers) Ltd. This machine is capable of forward and reverse movements, can elevate to a height of some 30 ft., and is able to move the storage pallet sideways in either direction into its associated storage rack. Racks and pallets have been manufactured and supplied by Guest, Keen, Iron and Steel Ltd., Dowlais. Space has been provided for duplication of the entire storage system at some future date.

The overhead cranes in the press shop, rod mill and warehouse are built by Acrow and supplied by Demag. A

Nick and break machine with a capacity up to 1½ in. The pointing head is at the immediate right of the operator





Coiled rod being fed into the head of the Farmer-Norton Hydrabench. Two coils are normally drawn at once, the second coil passing through the upper set of guide rolls

feature of all of these is that they run on tracks suspended from the roof beams instead of the conventional two-support gantry. The main shop crane of five tons' capacity has weighing equipment as an integral part of its fittings; weighing is accomplished by having a load cell in the hook connected to a digital recorder installed in the cab. Direct contact with a centrally situated weigh office is maintained by means of a radio link.

A further novel feature of the crane installation is the fact that the rod mill crane cab and crab can be transferred to the extrusion shop crane traverse, thus enabling a double "lift" to be obtained when necessary for major press maintenance.

Yet another feature is to be found in the fact that the rod mill and the small despatch warehouse cranes are able to sweep the same area between the two shops, although their paths are at right-angles to each other. This is achieved by the provision of two small turntables where the tracks would normally cross each other, each capable of turning through an angle of 90°. A safety device, operating to halt the crane against which the turntables are set before it can derail, is incorporated.

Floors throughout the new extension are in Stelcon steel-faced, pressed concrete tiles and Stelcon anchor plates; these, from previous experience within the works, are known to give the hard wear, freedom from "scuffing" and ease of maintenance essential in buildings of this type.

Finally, the quality of the artificial lighting provided has already drawn comment. Briefly, it is provided by a mixture of tungsten filament and mercury discharge lamps—experience having shown that this provides comfortable and adequate illumination economically, coupled with truer colour reaction than encountered with either source alone.

MEN and Metals

Noted for his work on the application of scientific research, the **Rt. Hon. the Earl of Halsbury** has been elected President of the Machine Tool Industry Research Association. From 1949 to 1959, Lord Halsbury was the first managing director of the National Research Development Corporation, and in this capacity was associated with machine-tool research at the Manchester College of Science and Technology.

It has been announced by Bristol Aerojet Limited that **Mr. R. P. Rutter** has been appointed secretary of the company in succession to **Mr. G. Hanby,** who has taken up an appointment with Bristol Aircraft Limited.

In connection with its plans for expanding its export business, Elliott-Automation Limited has appointed **Mr. Keith Newlands** as director of overseas operations.

An announcement from the Manganese Bronze and Brass Company Limited states that **Dr. Ivor Jenkins,** D.Sc., has accepted an appointment as director of metallurgical research with the company and its subsidiaries. He will take up his appointment from November 1 next. Dr. Jenkins has been chief metallurgist to The General Electric Company Limited since 1952. He joined the scientific staff of the research laboratories of the G.E.C. at

Wembley in 1934. After leaving there for a time in 1944-45 to assist in the establishment of a new research laboratory for the Whitehead Iron and Steel Company Limited, at Newport, Mon., he returned to the G.E.C., where he succeeded the late Mr. S. V. Williams as head of the metallurgy department. He is a member of the Council of the Institute of Metals and was a Vice-President of the Institute for 1959-60.

News from Powder Metallurgy Limited, a subsidiary of F. W. Berk and Company Limited, is to the effect that **Mr. L. A. Fletcher** has been elected a Fellow of the Institute of Linguists.

It is announced by West Instrument Limited that **Mr. Leslie Holdbrook,** B.Sc., will represent the company in N.E. London, Essex, Suffolk, Cambridge and Norfolk.

Appointed general manager of the International Division of U.S. Industries Inc., **Mr. T. O. Thomas,** B.A., joined the organization in 1958 as export manager of its Clearing Division, manufacturers of mechanical and hydraulic presses.

London Transport has announced that **Mr. H. E. Styles,** B.Sc., F.R.I.C., F.S.S., F.Inst.Pet., has been appointed director of research in succession to **Mr. A. T. Wilford,** who has retired. **Mr. A. G. Collings,** B.Sc., F.R.I.C., has been appointed assistant director of research.

With effect from Tuesday last, **Mr. J. Large** has been appointed general manager of the winding wires division of British Insulated Callender's Cables Limited. He joined the former British Insulated Cables in 1943 at their Edinburgh factory.

Acid Gold Plating

In the manufacture of printed circuits, electrolytes that attack the adhesives used are of little value. This article describes the development of an electrolyte free from this defect which offers a high hardness, low electrical resistance, pure gold deposit with low stress and freedom from porosity. For most materials direct plating is satisfactory.

DEVELOPED to provide an electrolyte which is not harmful to adhesives used in the manufacture of printed circuits and which will provide a pure gold deposit of high hardness, the Engelhard acid gold process is readily controlled.

Compared with more conventional processes, the throwing power is at least as good. The deposits, whilst of high hardness, are of fine gold, and of low stress and porosity. The hardness of the deposits is not less than 100 D.P.N. The deposits are readily soldered, have a low electrical contact resistance and, because of the high hardness, have superior mechanical properties to those obtained from conventional fine gold solutions.

Following a suitable pre-treatment, the deposits may be applied directly to silver, nickel and copper, and to alloys of the latter, including copper-beryllium, phosphor-bronze and nickel-silver. With most other base metals it is recommended that an undercoat be applied of copper, nickel or silver.

The composition of the electrolyte is as follows: gold potassium cyanide $KAu(CN)_2$ 1-100 gm/L. (0·146-14·6 oz. troy/gal.), diammonium hydrogen orthophosphate $(NH_4)_2HPO_4$ 5-500 gm/L. (0·73-73·0 oz. troy/gal.), potassium dihydrogen orthophosphate KH_2PO_4 5-500 gm/L. (0·73-73·0 oz. troy/gal.).

For small installations, heat-resisting glass vessels are quite satisfactory, but the use of water jackets is advocated if only for reasons of safety. For larger installations, rubber-lined mild steel tanks have been found to be completely satisfactory.

Heating is required under certain operational conditions and, since temperature control is desirable, thermostatically controlled immersion heaters are recommended.

The electrical equipment should contain an ammeter and resistance board, the latter having both coarse and fine adjustment. It is important to incorporate in the circuit an amp.-min. meter suitable for providing a direct record of the quantity of metal plated from the solution.

The working voltage will be 1·5-3·0 V, this being conveniently supplied by a generator or full-wave rectifier capable of providing a reasonably smooth D.C. output.

Equipment for continuous filtration is not necessary, but periodic filtration is desirable to ensure the production of smooth deposits.

The process is best operated using insoluble anodes. Pure platinum sheet may be used, but an entirely satisfactory and less expensive alternative is platinum-coated titanium. The latter is particularly suitable since because of its relative cheapness, large anode areas may be used, giving excellent current distribution over the articles being plated.

Using the same basic solution but at different gold metal contents, a range of operating conditions may be employed, depending upon the application, producing deposits of appearance varying from matte through semi-bright to fully bright. The following is but one example of the range of conditions possible. Other operating conditions are indicated under the heading "Solution Concentration".

Agitation: moderate to vigorous.

Cathode current density: 8 amp/ft² (0·860 amp/dm²).

*p*H: 5·2 to 5·8.

Solution concentration: 7 gm/L. (as Au).

Temperature: 70°-75°C.

The gold is in the monovalent state. Therefore, assuming a cathode efficiency of 100 per cent, the process

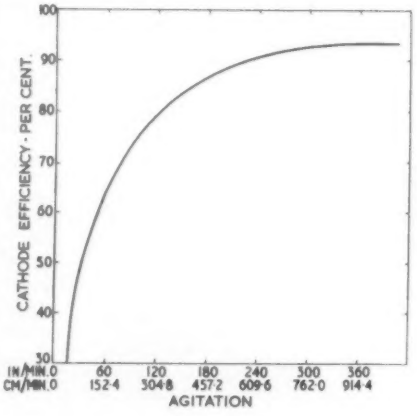


Fig. 1—Effect of agitation on the cathode efficiency (reciprocating cathode). Concentration 1 oz. troy/gall. (6·84 gm/L.); Current density 8 amp/ft² (0·860 amp/dm²); Temperature 90°C; pH 5·5

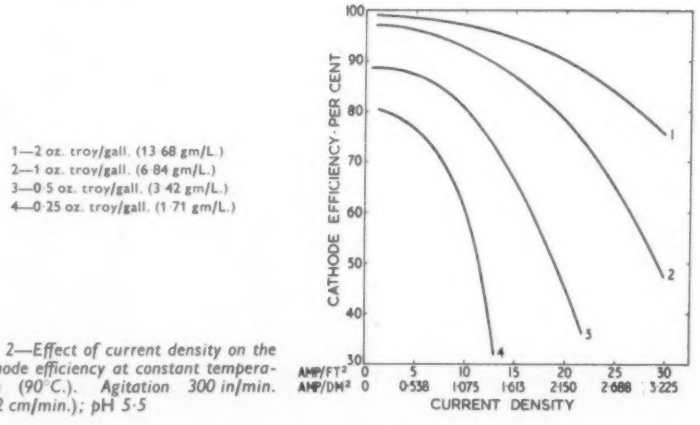
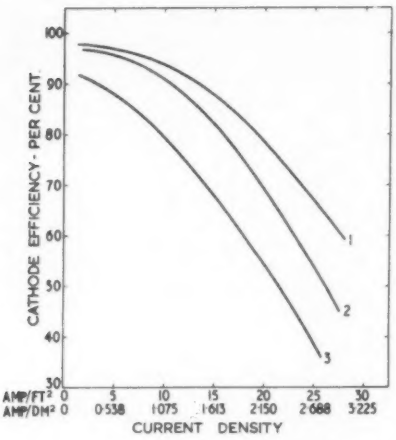


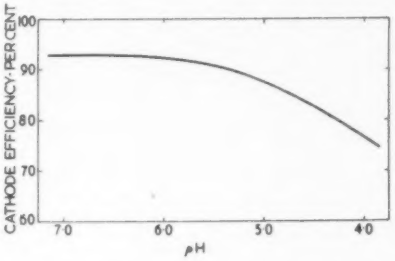
Fig. 2—Effect of current density on the cathode efficiency at constant temperature (90°C.). Agitation 300 in/min. (762 cm/min.); pH 5·5



Left: Fig. 3—Effect of current density on the cathode efficiency with constant concentration of 1 oz. troy/gall. (6·84 gm/L.). Agitation 300 in/min. (762 cm/min.); pH 5·5

1—Temperature 90°C. 2—Temperature 70°C. 3—Temperature 50°C.

Below: Fig. 4—Effect of pH on cathode efficiency. Concentration 1 oz. troy/gall. Current density 8 amp/ft² (0·860 amp/dm²); Temperature 80°C.; Rocking cathode movement 2-3 in. 50 cycles/min.

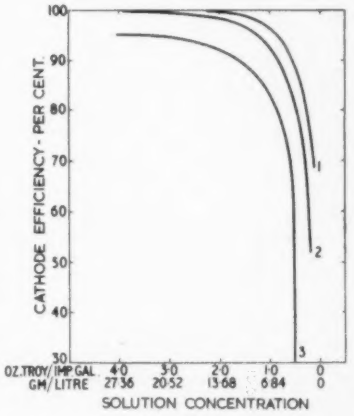


Below: Fig. 5—Effect of solution concentration on cathode efficiency. Temperature 90°C.; Agitation 300 in/min. (762 cm/min.); pH 5·5

1—Current density 2 amp/ft² (0·215 amp/dm²)

2—Current density 8 amp/ft² (0·860 amp/dm²)

3—Current density 18 amp/ft² (1·935 amp/dm²)



will deposit 0·123 gm. of gold per amp.-min. Thus, under the conditions above, the process deposits approximately 0·0010 in. (25·4 μ) in 50 min.

Each of the operational variables can have a considerable effect upon the nature of the deposit and the efficiency, and the following is intended as a guide to the results that may be expected.

Agitation. The use of a reciprocating cathode is, perhaps, the most convenient form of agitation. A suitable amount of movement is 300 in/min. (762 cm/min.). This may be described as moderate cathode agitation. The effect of agitation upon cathode efficiency is shown graphically in Fig. 1. It will be seen that while the cathode efficiency decreases steadily with agitation less than above, greater agitation does not give a corresponding increase. It does, however, increase progressively the maximum permissible cathode current density which can be used before roughness and porosity are encountered.

Cathode Current Density. As stated above, a typical average cathode current density is 8 amp/ft² (0·860 amp/dm²). Figs. 2 and 3 show graphically how the efficiency is related to the cathode current density, as well as giving some indication of the effects of variation in electrolyte concentration and temperature. The average cathode current density used will depend upon the shape and size of the articles being plated. Higher or lower values may be dictated to some extent by the shape of the work, but high cathode current densities may give rise to uneven deposits or even "burning" on corners or projections. At current densities lower than those recommended, no appreciable difference in appearance can be detected.

Hydrogen Ion Concentration. As may be seen from Fig. 4, the *p*H of the solution does have an influence upon the cathode efficiency. However, the effect is not appreciable until the solution becomes rather acidic.

The *p*H of the solution also affects the appearance of the deposit. At *p*H values higher than the range quoted, the deposit tends to become progressively more matte. On the other hand, lower *p*H values do not affect appearance until below *p*H 4·0, when the separation of an insoluble gold compound causes roughness, and loss of efficiency can cause porosity.

Solution Concentration. The effect solution concentration has upon cathode efficiency is illustrated graphically in Fig. 5. Also affected materially is the maximum permissible cathode current density. When industrial thicknesses are required, at least 7 gm/L. of gold (Solution No. 3605) should be used. In fact, as may be seen from the following, considerable advantages are gained by increasing the solution concentration.

An increase in concentration to 14·0 gm/L. of gold (Solution No. 3606) permits the deposition of a thickness of 0·0010 in. (25·4μ) in 25 min. (16 amp/ft² — 1·72 amp/dm²), without loss of appearance. Even higher rates of deposition may be employed when some loss of the semi-bright appearance may be tolerated.

Within the temperature range 60°-65°C., and at the gold concentration 21 gm/L. (Solution No. 3607), an almost fully bright deposit of attractive appearance may be obtained at 16 amp/ft² (1·72 amp/dm²).

A bright pure gold deposit may be obtained with an electrolyte containing 28 gm/L. (Solution No. 3608) operated at room temperature. Vigorous agitation is desirable together with the use of a cathode current density of 12-20 amp/ft² (1·29-2·15 amp/dm²).

For decorative thicknesses, lower concentrations are to be recommended. However, the concentration should not be allowed to fall below 0·25 oz/gal. (1·71 gm/L.) of gold metal, or the effect known as "burning" will occur even at low current densities. In general, the solution concentration should not fall below 80 per cent of the nominal value. A method of analysis of the solution for gold metal is given at the end of this article.

Within the temperature range 70°-75°C. the deposit is of a light colour and semi-bright. Some brightness is lost either side of this range, and at low temperatures the deposit is quite matte and dark.

Some indication of the effect of temperature variation upon cathode efficiency may be seen from Fig. 3. As pointed out under the heading "Solution Concentration", it must be remembered that higher solution concentration and a greater degree of agitation can have a remarkable effect upon appearance, cathodic efficiency and maximum cathode current density permissible.

Since this process employs insoluble anodes, metal plated from solution must be replaced by addition of a gold compound. This is conveniently added in the form of a liquid concentrate which merely requires volumetric measurement.

The addition should be made regularly, as required, and should always be well stirred into the bath. The exact quantity to be added will depend upon the amount of work passed through the bath since the last addition and the efficiency of the operational conditions. The following example illustrates the principles involved.

The edge connectors of six printed circuit boards were plated with 0·0002 in. (5·0 μ) of gold. Each board had 15 connectors of width 0·12 in.

(3·05 mm.) and length 0·5 in. (12·70 mm.). Therefore, the total area plated was 5·4 in^2 (34·84 cm^2). Using a cathode current density of 8 amp/ft^2 (0·860 amp/dm^2), the current passed was 0·3 amp. Since the efficiency was known to be 93 per cent, the total plating time was 10·75 min. The total number of amp-min. passed, then, was 3·23, corresponding to a weight of very nearly 0·4 gm. Thus, the volume of concentrate added at the end of the run was 10 mL.

Solution Analysis. The gold content of the electrolyte may be determined by using the method described below.

Pipette 25 mL. of the stirred solution into a 250 mL. conical flask. Place in a fume cupboard and add 5 mL. concentrated sulphuric acid. If it is known that the solution is contaminated with organic materials, add 2-3 gm ammonium nitrate. Boil down to white fumes and continue heating for ¼ hr. Allow to cool. Cautiously wash down the inside of the flask and heat again to dense white fumes. Allow to cool. Cautiously wash down the inside of the flask and dilute the content to approximately 100 mL. Simmer gently on a warm hotplate for approximately 1 hr. to complete the coagulation of the metallic gold particles. Filter off the gold, using a quantitative filter paper and wash several times with hot distilled water. Dry and completely ignite the paper. Weigh the residue as gold metal.

Weight in gm × 40 = gm. gold metal/L.

Weight in gm × 5·84 = oz. troy gold metal/gal.

The fuming operation must be conducted in a fume cupboard because of the evolution of the highly dangerous hydrocyanic acid gas.

Fume Cleaning

TRANSPORTABLE PILOT PLANT CONSTRUCTED TO DEMONSTRATE EFFICIENCY OF VENTURI SCRUBBERS

IN such diverse applications as metal smelting and refining, chemical manufacture and sand grading plants—indeed, in almost every instance where dust-laden fumes are produced—Ambuco venturi scrubbers are capable of eliminating the public nuisance which such fumes cause, and of facilitating the recovery of the materials concerned should they be of sufficient value.

To demonstrate the results obtainable by the venturi scrubbing process, a transportable pilot plant has been constructed by Ambuco Limited, Standbrook House, Old Bond Street, London, W.1, a member of The Gold Fields Mining and Industrial Group.

These scrubbers are made under licence from Waagner-Biro and incorporate a process in which the fumes are caused to pass through two complete cones of water, ensuring up to 99·6 per cent removal efficiency of most entrained solids in the range 5 to 0·01 microns.

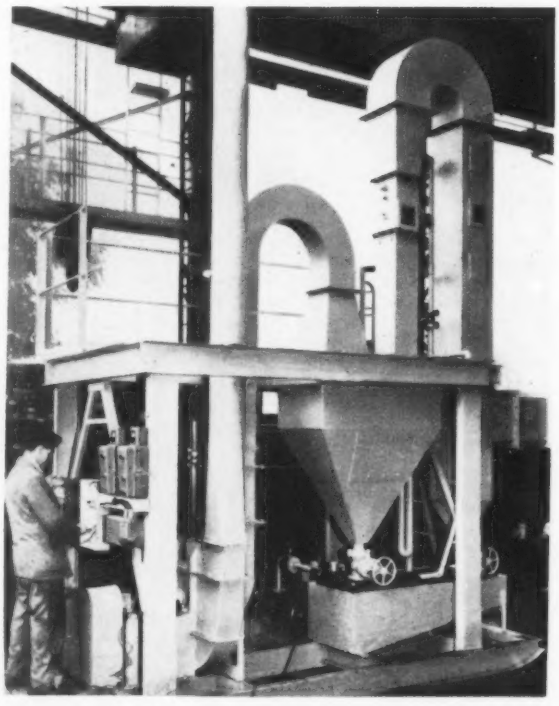
The arrangement of the pilot plant is shown in the accompanying illustration. The fumes are drawn through the scrubber by the fan, positioned on the left at the base of the exhaust stack. The dust-laden fumes enter the scrubber through the ducting on the extreme right and are then drawn up the first vertical column. Here, whenever hot fumes are encountered, pre-spraying takes place to effect a temperature reduction.

The fumes are then drawn down the second column, where, on a level with the inspection port, a spray forms a double cone of water at the top of the venturi. As the fumes are drawn through these cones, the entrained particles are separated from the fumes and carried in the water to the hopper beneath. The clean fumes pass through the top of the hopper and are expelled through the exhaust stack via the fan.

The entrained solids settle in the water in the hopper and may be drawn off periodically or continuously as required, and either disposed of with other liquid effluent or passed through a suitable filtration device for reclamation or disposal as required.

A unique feature of this pilot plant is that as it uses one full size venturi tube there is no scale effect and the efficiency demonstrated will be achieved on the subsequent larger installation. In practice, the venturi tubes are assembled in groups to provide the required throughput, and as much as 200,000 ft^3/min. may be handled by one plant.

The fabrication of the pilot plant was carried out for Ambuco by A. A. Thornton (Teddington) Limited, of Feltham, Middlesex.



Portable pilot plant used to establish optimum working conditions for Ambuco venturi scrubbers

Industrial News *Home and Overseas*

Zinc-Rich Paints

It is announced by the **Zinc Pigment Development Association** that the three of its members who manufacture zinc dust pigments have been awarded a contract by the Expanded Research Program of the American Zinc Institute and Lead Industries Association to carry out a joint programme of research to improve the characteristics of zinc-rich paints. Most of the practical work will be carried out in the research laboratories of the Imperial Smelting Corporation Ltd. at Avonmouth, with the assistance of Amalgamated Oxides (1939) Ltd., of Dartford, and Durham Chemicals Ltd., of Birtley. A committee representing all three companies and the Zinc Development Association will meet frequently to guide the research.

Initially, attention will be given to developing better paints for the priming of motor car underbodies. Zinc-rich paints are already finding extensive use for this purpose in the U.S.A., where the vast quantities of salt used each year to remove snow in the northern cities have created a serious corrosion problem with chassisless construction. With the co-operation of the motor industry it is hoped to be able to formulate paints with better adhesion, flexibility and welding characteristics than those currently available. Later on, work will be done on paints for structural steelwork and marine applications.

The Expanded Research Program was established in 1958 to sponsor fundamental and applied research on zinc and lead with a view to developing the uses of the metals and their derivatives. The Program is supported by metal producers and mining companies in the U.S.A. and the British Commonwealth and is being carried out in several countries. The zinc and lead industries will make the results available for the benefit of the whole of the industries concerned.

Die Sets

News from **Winstanley (Die Sets) Ltd.** is that they have further added to their die set manufacturing capacity and increased the labour force substantially. Mr. D. J. Barrow (lately contracts supervisor of Tank Linings Ltd.) has joined the company as production engineer.

Laboratory Equipment

Two exhibitions are being staged in Cardiff and Manchester by **Griffin and George Limited,** at which modern laboratory equipment will be shown. These exhibitions will be held in the Welsh College of Advanced Technology, Cathays Park, Cardiff, from September 12 to 14 inclusive, and at the Chorlton Town Hall, Cavendish Street, Manchester, from September 18 to 21 inclusive.

An Aluminium Floating Boom

An impressive feature associated with the Tummel Garry project of the North of Scotland Hydro-Electric Board at Pitlochry Dam, by Loch Faskally, is the floating boom designed to prevent buoyant trash from blocking the turbine grids. This structure, 600 ft. long, was built by **Non-Corrosive Metal Products Limited.** It consists essentially of 24 light alloy pontoons, suitably linked together and appropriately anchored at each end to the shore and at four other points offshore. Provision is also made for opening a section of the boom if required, so that accumulated debris can be disposed of by sluicing it away over the flood gates.

The pontoons were assembled by Argonaut welding and consist basically of two rows of three rectangular water-tight compartments approximately 7 ft. long by 1 ft. 10 in. wide and 10 in. deep, formed from ¼ in. thick plate. On the upstream side of each pontoon three removable skirts are fitted, made of 10 gauge flanged aluminium alloy plate, these being designed to intercept trash. On the top of the pontoons is a walkway made of extruded "Duratread", this material being self-draining and giving excellent grip even under icy or slimy conditions.

The aluminium alloys used in this assembly were all supplied by **The British Aluminium Company Limited.** Pontoon buoyancy tanks (flanged plate), diaphragms and stiffeners (flanged plate), trash skirts (flanged plate), walkway supports and trash skirt supports (channel section), coupling pins (extruded section), coupling bolts (hexagon-extruded section), handrail (tubes) and handrail stanchions (castings), coupling links (castings)—these components are all in BA.28; the walkway is in extruded section to BA.24.

The use of aluminium alloys in various forms for this structure is dictated by the inherent resistance of the material to attack by acid water and the elimination of any need for painting, whilst it is clearly of assistance in promoting increased buoyancy. The boom was launched by **Balfour Beatty and Co. Ltd.,** who report that their task was simplified due to the light weight of the pontoons.

Synthetic Organic Acids

Developed after extensive research by the **Shell Laboratories** in Amsterdam, a new group of synthetic organic acids is now available from a pilot plant, and will be produced on a commercial scale as from January next.

The acids are being marketed under the trade name "Versatic". Although similar in some respects to other organic acids already on the market, these new acids are said to possess unique properties which will find important applications in the surface coatings, plastics, rubber, metallurgical and many other industries.

A £2 million plant to handle the acids when they go into commercial production is now under construction at Shell's large oil and chemical refinery complex at Pernis, near Rotterdam.

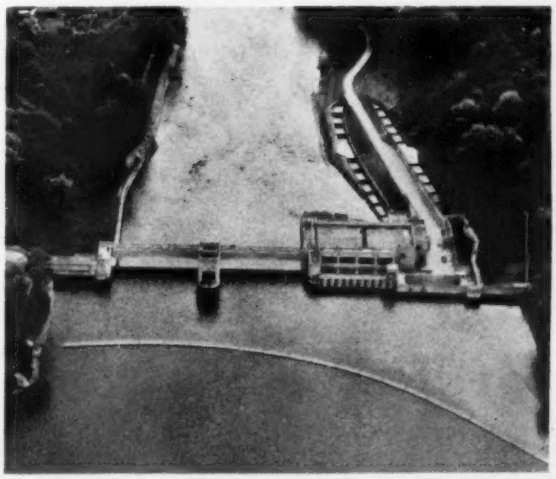
New Subsidiary Stores

A new warehouse has been opened by **British Insulated Callender's Cables Ltd.** in Haverton Hill Road, Stockton-on-Tees. This is subsidiary to the main stores and offices of the company's Middlesbrough branch in Norton Street, Middlesbrough.

The warehouse has a floor area of 4,000 ft^2 and will afford improved facilities for customer services. It will allow upwards of 100 tons of winding wires to be stored, together with PVC armoured cables (up to 0·06 in^2) and a large variety of connecting wires.

High Duty Rolling Mill

A contract has been placed with **Schloemann Aktiengesellschaft** by the Hutten-und Berhwerke Rheinhausen Aktiengesellschaft, for the construction of a new medium section mill. Some interesting aspects of its layout are:—two roughing trains to secure the high planned monthly output of more than 35,000 tons of widely varied products; the intermediate and finishing trains are to be of generously spaced, staggered arrangement. As a result thereof, and through the incorporation of hydraulic gear for traversing the stands, a change in the mill schedule will require only a minimum of time. When medium and heavy sections are being rolled it will, for example, be possible to start up the production of a different shape on one part of the mill, whilst manufacture of the previous item on the schedule continues on the other part.



An aerial view of the aluminium alloy floating boom in position at Loch Faskally in connection with the Tummel Garry project of the North of Scotland Hydro-Electric Board at Pitlochry

The extensive finishing line equipment needed to enable the diversified programme to be carried out is likewise to be supplied by Schloemann. The complete rolling mill plant will be about 545 yards long, and it is scheduled to go into production in 1963.

Rotary Melting Furnaces

It is learned from the **Monometer Manufacturing Company Limited** that their oil-fired rotary melting furnaces have been installed for the bulk melting of aluminium alloys by the Delta Metal Company Limited at its copper and alloy works in West Bromwich for the new pressure die-casting foundry.

Each furnace has an output of 30 cwt. in 45 min. They are economical in use, say the makers, giving reduced oil consumption per ton of metal melted, and make great saving in manpower, with most comfortable working conditions for the foundry personnel. The linings of the furnaces have a life of at least two years before they require to be renewed.

Air Cylinder

What may well be described as the smallest British air cylinder has recently been introduced by **Air Automation.** This cylinder is of ½ in. bore diameter, double acting, and is available in three standard lengths of stroke from ½ in. to 1½ in. It is arranged for rear manifold mounting and is considered suitable for mounting in confined spaces where there would be no room for pipework to ports.

The body of this cylinder is of brass and the rod of stainless steel, with synthetic rubber distributor type "U" seals on the piston, and a similar steel in the body.

A.I.D. Approval

It is reported by **Roto-Finish Limited** that they have received A.I.D. approval for their "Cahill" electroless nickel process and their "Tridur AL" chromate conversion process for aluminium under D.T.D. Specification No. 900/4728 and 900/4729 respectively.

The Cahill process is a method of plating by chemical reduction and produces a semi-bright, hard (VEN 450/550) coating of nickel-phosphorus alloy (90-92 per cent nickel—8-10 per cent phosphorus) on a variety of base metals: steel, copper alloys, aluminium. By a suitable activation process it can be used for plating ceramics and phenolic mouldings.

Tridur AL conversion treatment for aluminium and its alloys gives a high rate of corrosion resistance and maximum paint adhesion. Coatings are produced, it is stated, in 20 sec. to a maximum of 3 min., producing a yellow to khaki colour which can be dyed with various coloured aniline dyes if required.

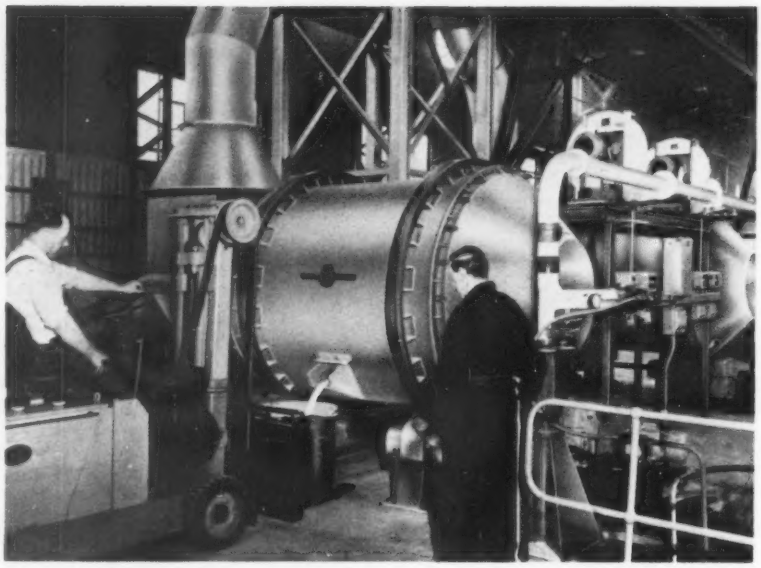
U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell 91 tons to 6,164 tons, comprising London 3,007, Liverpool 1,945 and Hull 1,212.

Copper stocks rose 273 tons to 21,125, distributed as follows: London 750, Liverpool 16,325, Birmingham 50, Manchester 3,925, Hull 50 and Glasgow 25.

Lead duty-free stocks fell 400 tons to 8,911 tons, comprising London 8,561, Glasgow 100, and Swansea 250. In-bond stocks fell 425 tons to 3,243 tons (all in London).

Zinc duty-free stocks fell 99 tons to 4,123, comprising London 3,084, Glasgow 206, Manchester 400, and Liverpool 433. In-bond stocks fell 3 tons to 2,460 (all in London).



Monometer oil-fired rotary melting furnaces for the bulk melting of aluminium alloys at the copper and alloy works of the Delta Metal Company at West Bromwich

Chemical Engineering Factory

On a recent week-end, the President of the **Kestner Evaporator and Engineering Company Limited** unveiled a plaque to commemorate the inauguration of the company's new foundry at Greenhithe. This foundry is the first part of the complete move of their works from New Cross to Greenhithe. Other shops which will eventually be transferred will be the Keebush production and machine shop, grinding, pump assembly and test, Keeglas and PVC fabrication, general plant erection and heavy plant erection, and finally the general laboratory, pilot plant and test laboratory.

A new drawing office is being built to house 60 draughtsmen. On completion, the factory floor area will be some 100,000 ft², and the move is expected to be completed in about six months. The new foundry is making castings of Tantiron, and lead alloy resisting castings. Five furnaces have been installed, giving an output of 10 tons of Tantiron castings per week, and there is room to increase this plant to double the output.

U.S. Nickel Consumption

News from Washington is that the Business and Defense Services Administration predicted over the week-end that U.S. consumption of nickel this year would be about the same as last year. "The anticipated rise in steel output during the third and fourth quarters as compared with the same quarters of 1960 would be expected to be accompanied by increased nickel consumption", B.D.S.A. said.

"The consumption rate for the balance of the year should be sufficient to bring the total for 1961 to about the same level as 1960." Because of the prospective increased consumption of nickel for the balance of the year and the present low inventory, consumers are expected to increase their reserve stocks during the months ahead.

Discussing supply, the report added: "The supply of nickel made available for U.S. consumption through normal commercial channels is more than adequate to provide for peacetime demand. In addition to the nickel normally imported for U.S. consumption, there currently are in excess of 20 million lb. of nicaro sintered nickel oxide in stocks available for distribution to United States industry. Ferro nickel also is being produced in the United States at an annual rate of about 22 million lb. (contained nickel) and offered commercially for sale."

Power Cables

Two mass-impregnated non-draining three-core 33 kV power cables, specially manufactured by the Power Cables Division of British Insulated Callender's Cables Limited to withstand stresses arising from installation on a steep gradient, have been installed by **British Insulated Callender's Construction Company Ltd.** as part of the Cwm Rheidol hydroelectric scheme, 12 miles inland from Aberystwyth in the Welsh mountains. The 4½ in. dia. M.I.N.D. cables, manufactured in single lengths of 1,800 ft., each weigh over 20 tons. Two steel-wire armoured PVC pilot cables have also been supplied.

Contract Announcement

News from **Yorkshire Imperial Metals Limited** is to the effect that the company has ordered a sectional cooling chamber, costing £3,000, from **Andrews Bros. (Bristol) Ltd.** It will be used in the production of copper tubing.

New Open Cut Tin Mine

It is reported from Sydney, Australia, that Aberfoyle Tin N.L. hopes to establish an open cut mine at the Ardlethan tin field in New South Wales. The company has negotiated an option to purchase mining titles covering the field. Diamond drilling, first stage in investiga-

tion of the size and grade of the ore body, has begun, and a sample batch of ore has been sent to the Australian Mineral Development Laboratories in Adelaide for testing. The directors of the company say the objective is to develop a large scale, low-grade, low-cost open-cut mining operation. Improved tin recovery techniques in recent years and higher world tin prices have improved the value of the prospect, they add.

The John Thompson Group

For the first time in the long history of the **John Thompson Group of Engineering Companies,** the complete London sales organization is now centralized in a new headquarter building in Woburn Walk, Tavistock Square, London, W.C.1. Seventeen home companies are now represented in these new offices and this concentration will lead to greater co-ordination and added efficiency in London where the outlook appears very favourable for group activities.

In the new offices, a room has been set aside to display photographs and models of the main products of the group. These include: steam boilers of all types from the largest power station boilers to small boilers of only 200 lb. of steam per hour, together with water treatment plant and instrumentation; pressure vessels and special fabrications for chemical plants, oil installations and other requirements in industry; pressings and fabrications for the motor trade; ash and dust and material handling systems for power stations and industry, and complete pipework fabrications.

Wolverhampton remains the head office of the group and for the majority of individual firms, but among the companies which have recently entered the group and are represented in the new London offices are Thompson Brothers, Darham Industries, John Thompson Compost Plant, Ltd., and Thompson-Tappan.

Failing to Export

The leading article in this issue of METAL INDUSTRY is based on a survey which was carried out recently by the Export Action Now Committee of the **Institute of Directors** on the reasons why many firms fail to export.

One of the objects of this survey was to discover company attitudes to exporting. A total of 52 firms were questioned, all with less than 300 employees. The survey was confined to smaller firms because it was felt that it was among these that the greatest expansion of exports was possible.

New Furnace Installed

A furnace for stress-relieving large fabrications and castings weighing up to 40 tons has been supplied to Dorman Long (Steel) Ltd. by **The General Electric Company Limited.** It is installed in the company's Redcar iron and steel works, and is capable of operating at a maximum temperature of 1,000°C. The furnace is of the bogie-hearth or car-bottom type and has a door opening 10 ft. wide by 7 ft. high to the spring of the arch, and a heated length of 20 ft.

The walls of the furnace consist of high-grade semi-refractory blocks backed up with insulating brickwork, whilst the roof, which is of arched construction, is built up from special semi-refractory shapes backed with insulating brickwork and powder.

The heating elements, which are made of high-grade nickel-chrome strip, are arranged on the side walls, roof and door. With all elements in circuit, the total rating is 600 kW, comprising 60 kW on the door and 540 kW arranged in four zones of equal length and power input.

Galvanizing Plant

It is reported by **Head Wrightson Machine Co. Ltd.** that they have secured a contract worth approximately £500,000 for the supply of hot dip galvanizing plant placed by the Steel Company of Wales for the Abbey Works, Port Talbot. The plant will be of the Armco Sendzimir continuous type. The furnace for the annealing and surface penetration will be built by **AEI-Birlec,** who will be subcontractors for the Head Wrightson firm, which is responsible for the design and engineering of the complete plant. The plant will be capable of galvanizing cold reduced strip up to 54 in. wide and from 0·015 to 0·062 in. thick at a processing speed reaching 150 ft/min. Most of the plant will be built on Teesside.

Aluminium in Mexico

In mid-June, the Export-Import Bank of Washington authorized a 6·5 million dollar loan for Aluminio, S.A. de Mexico, to be applied to the construction of a new plant for the manufacture of aluminium in the city of Vera Cruz.

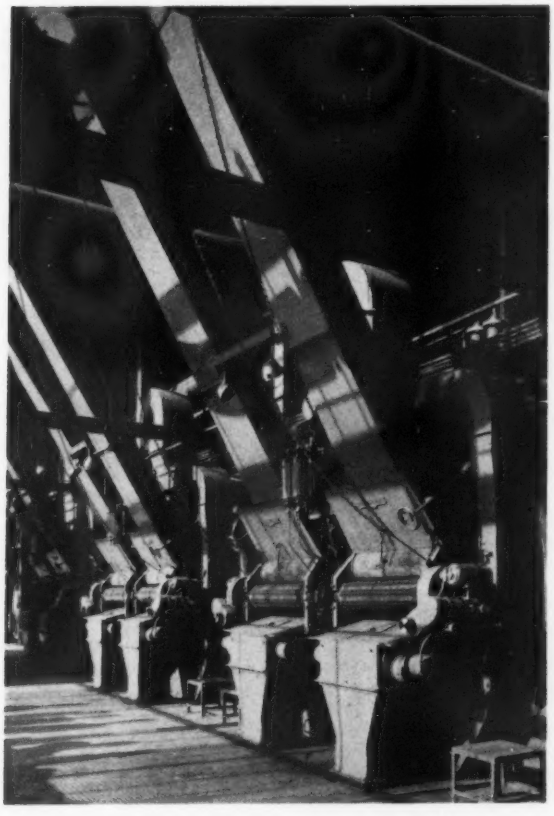
Eximbank President Harold F. Lindner announced that the above firm would devote the proceeds of the loan to the purchase of machinery and materials for use in a smelter requiring a total investment of 16·5 million dollars and capable of turning out 20,000 tons of aluminium annually. The choice of the plant site was governed for the most part by considerations of the availability of railway, highway and maritime transportation facilities.

The credit will be used in meeting dollar expenditures in connection with the purchase of smelter machinery and special equipment such as trucks, conveyors, elevators, cranes and mixers. Raw materials for the smelter, such as aluminium, aluminium fluoride, and cryolite, will be imported, since these products are not available in Mexico.

Pioneer Industries in Malaya

In June last it was announced in the *Board of Trade Journal* that ten aluminium products in the light metal manufacture industry had been proposed for Pioneer Status. The Government of the Federation of Malaya have now announced that the Light Metal Manufacture industry and the following eight of those ten products have been declared a Pioneer Industry and Pioneer Products under the Pioneer Industries (Relief from Income Tax) Ordinance, 1958:—

(1) Aluminium household utensils and food containers—all types; (2) aluminium roofing and wall cladding sheets; (3) aluminium complete buildings; (4) aluminium building frames and parts thereof; (5) aluminium windows, sun control equipment, and parts thereof; (6) aluminium transport and static tanks, vehicle bodies, marine constructions and parts



A typical Shell boiler installation, where the diverse products of the companies within the John Thompson Group enable complete plant to be designed and manufactured for clients. The installation includes Shell boilers, coal firing equipment, instrumentation, ducting, coal and ash handling equipment etc.

thereof; (7) aluminium sinks; (8) aluminium ladders. All enquiries regarding this notice should be made to the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, London, S.W.1, quoting Ref. C.R.E. 1236/4/G.

Copper in Yugoslavia

A new copper mine with an annual capacity of 3,600,000 tons of ore is reported to have been put into operation recently at Majdanpek, Yugoslavia. Under the Five-Year Plan, it is proposed to further increase the capacity of the mine, and the necessary provision of equipment, etc., is to commence next year.

Malayan Tin Metal

Malaya produced 106,723 piculs of tin-in-concentrates in June, containing 4,807 tons of tin metal, based on the true assay of 75·67 per cent, according to Malayan Mining Statistics. This compared with a May output of 105,456 piculs containing 4,745 tons of tin metal based on the true assay of 75·59 per cent.

The average daily rate of production in June was 3,557 piculs of tin-in-concentrates, compared with 3,402 piculs in May. Deliveries of tin-in-concentrates from mines to smelters in June amounted to 114,915 piculs, compared with 110,521 piculs in May.

At the end of June there were 70 dredges, 515 gravel pump mines and 53 other tin mines in operation, making a total of 638 active tin mines. This compared with end-May figures of 69 dredges, 506 gravel pump mines and 51 others, making a total of 626.

News from Birmingham

Speaking at the monthly meeting of the Midland Regional Board for Industry, the chairman, Major C. R. Dibben, referred to the chronic labour shortage as the dominant feature on the industrial scene at the moment. It was, he said, one of the major problems facing Midland industry, marked most of all in the building and general engineering industries. Mr. P. J. L. Homan, regional controller of the Board of Trade, said the number of schemes for new factories in the Midlands during the second quarter of the year which had been approved numbered 78, covering a total area of 1,600,000 ft². The number of industrial development certificates granted showed a slight increase on the total in the first quarter of this year, but remained well below 1960 figures. The cost of the 78 proposed new buildings was estimated at about £5,000,000.

The severe taxation proposed by the Chancellor in his "little Budget" seems likely to hit the car trade during the coming months, and is likely to lower the orders for steel sheets and other metal products used in the industry. The full effects may not be known for a long time. Activity in the metal trades is at a low ebb at the moment, because of the industrial holiday, but it seems certain that buyers will curtail business in the future.

Bauxite in Australia

The Minister for Territories, Mr. Paul Hasluck, announced that the Government has agreed to grant Duval Holdings Pty. Ltd. rights to prospect for bauxite for 18 months in the Govet Peninsula area of the Northern Territory. He said if bauxite was found in sufficient quantity, and subject to satisfactory arrangements for marketing, the company might apply by March, 1963, for a special mineral lease to mine and export 10,000,000 tons of bauxite from a defined portion of the area prospected.

Depending also on the outcome of the prospecting and the availability of other necessary resources, the company could also apply by March 1963 for a second special mineral lease over an additional part of the area prospected, Mr. Hasluck said. The company would be given three years from the date of commencement of of the second lease to assess the economic feasibility of an alumina plant based on bauxite from the two leases.

Mr. Hasluck said that British Aluminium Company Ltd. also had bauxite rights in the Govet area. The British Aluminium Co. Ltd. held a special mineral lease, the terms of which require development plans to be submitted to the Government by the end of 1962.

Indonesian Tin Smelter

Indonesia is shortly to start building its first tin smelter on the Java island of Bangka. A contract for construction of the smelter has been signed by the director of the Indonesian State Tin Corporation and a representative of the West German firm of Klockner-Industrie-Anlagen. The new plant is expected to take 2½ years to build. When completed, it will provide Indonesia with its domestic tin requirements.

LIGHT METALS STATISTICS IN JAPAN
(February 1961)

Classification	Production	Shipment	Stock	Export
Alumina	31,823	26,900	20,346	4,794
Super purity Al	108	91	689	0
Primary Al	10,686	11,844	4,719	0
Secondary Al	4,978	4,918	948	0
Wrought products (Al and its alloy)	13,309	13,514	3,799	846
Plate, sheet and strip	8,474	8,711	2,404	
Foil	866	912	278	
Rolled and extruded shape	2,137	2,159	374	731
Forgings	41	—	—	—
Electric wire	1,791	1,732	743	115
Powder, flake and paste	—	—	—	—
Casting	6,326	—	—	—
Sand and permanent mould	3,459	—	—	—
Die	2,867	—	—	—
Sheet products	2,695	2,880	1,210	61
Primary Mg	205	194	54	—
Secondary Mg	227	249	408	—
Mg casting	36	—	—	—
Sponge Ti	190	139	1,065	116
Super purity Al (March)	107	100	696	—
Primary Al (March)	11,777	12,561	3,935	0

Company Reports

A Merger

It is reported that Alfred Herbert Ltd. has acquired the Huddersfield firm of William Whiteley and Sons, makers of metal planing machines, etc. For a number of years, Alfred Herbert has acted as selling agents for some of the Whiteley productions.

Firth Brown Tools

Dividend 12½ per cent year to March 31, 1961 (same). Group net profit £344,444 (£255,344), after depreciation £125,598 (£139,233) and tax £349,465 (£212,119). Dividends £134,750 (same), exceptional expenditure to be incurred on reorganization of works £50,000 (nil), contingencies reserve £16,000 (£11,000), fixed assets replacement reserve £106,500 (£50,000). Forward £347,637 (£310,443).

George Kent

Final dividend 6 per cent, making 8½ per cent year to April 1, 1961 (same equivalent). Parent net profit, after tax, £400,222 (£381,742). Group profit £323,319 (£307,061). Charge for estimated U.K. income tax for 1961-62 is £140,173.

Wickman and Company

Dividend 11 per cent, tax free, on £2,800,000 for year to March 31, 1961 (10 per cent net on £2,100,000). Group net profit £682,850 (£515,877), after £79,999 off jigs and tools and U.K. tax £751,484 (£510,194). Attributable to holding company £590,429 (£449,543). To fixed assets replacement reserve £137,000 (£129,000). Dividends £325,150 (£227,150).

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

T.A. Metal Works Limited (694003), 9 The Grove, Ealing, W. Registered May 30, 1961. Nominal capital, £1,000 in £1 shares. Directors: Thomas Anderson and Mrs. Joan Anderson.

Tees Recovery Service Limited (694080), 26 Craven Street, W.C.2. Registered May 31, 1961. To carry on business of waste and scrap merchants, etc. Nominal capital, £1,000 in £1 shares. Directors: Brian J. Crawford and Russell P. Crawford.

Frank Aston and Co. Limited (694931), Lancaster House, 67 Newhall Street, Birmingham. Registered June 8, 1961. To carry on business of iron, steel and metal workers, etc. Nominal capital, £2,000 in £1 shares. Directors: Frank K. Aston, Mrs. E. E. Aston and Aneurin Curtis.

L. Herve Sales Limited (694989), 37-8 Chancery Lane, W.C.2. Registered June 8, 1961. To carry on business of metal merchants, etc. Nominal capital, £5,000 in £1 shares. Director: Brian K. Herve.

G. L. Metal Co. Limited (695516), 81-3 Wharfdale Road, Tyseley, Birmingham, 11. Registered June 14, 1961. Nominal capital, £1,000 in £1 shares. Directors: Philip R. Laister and Ronald J. Glenn.

F. C. Larkinson (Peterborough) Limited (695690), 18 St. George Street, W.1. Registered June 16, 1961. To carry on business of scrap metal merchants, etc. Nominal capital, £100 in £1 shares. Director: Sigmund Sternberg.

Metal Market News

THE non-ferrous metal markets last week were a good deal under the influence of the statement made by Mr. Selwyn Lloyd about the various steps to be taken in order to cope with the downward slide in the pound. On the whole, there is a sense of disappointment that the measures to be put in hand are very much "the mixture as before", but it may well be that we have not yet heard the end of the story. Trading on the market was not brisk, and this goes for the situation in regard to business with the consumers, who, with the holidays just about to start, have evinced very little interest in buying. Metal Exchange stocks are continuing to move in the direction they have followed during the past month and more, and it would appear that this tendency is likely to continue. Copper stocks in warehouse, as reported on Monday last week, were up by 875 tons to 20,852 tons, and it is fairly generally expected that this tonnage will go on rising, at any rate so long as no strike breaks out in Chile. On that matter, the news last week was conflicting, but it did not appear that the market was reacting very strongly to the various reports coming through. If a strike occurs, it may be doubted whether initially much, if any, upward movement in the copper market will be seen, but a prolonged stoppage would have an effect, the extent of which cannot be gauged.

Of the other metals, the L.M.E. warehouse stocks of tin fell by 230 tons to 6,255 tons, and here again it looks as though this trend would continue. Lead reserves dropped by 89 tons to 12,979 tons, while stocks of zinc fell from 6,809 tons to 6,685 tons. Turnovers last week were not up to average, but there is nothing surprising in that, considering the time of year. On this matter of turnover, it is a fact that so far this year, the Metal Exchange has made a very good showing, and the committee has every reason to be pleased at the way things have been going. Whether all those who could make use of the Exchange for hedging facilities do so is another matter, but it is probable that on the whole this type of activity is increasing as consumers of copper, and merchants, realize the great advantage to be derived from protecting their holding of copper against loss resulting from a long position and a declining price.

Of all the metals under consideration in this report tin, last week, was the one to achieve the most outstanding position. After climbing up nearly to £940 some weeks ago, the price reacted and has recently looked rather sorry for itself in the face of a marked abstention from buying by the users who had helped themselves before the rise. In the second half of the week, particularly, the tone was very firm, and finally a gain of £13 10s. 0d. was registered in cash and £13 in three months, the closing prices being £923 cash and £935 three months. The turnover was 1,200 tons. In copper, some 12,300 tons changed hands, cash closing 25s. down at £231 5s. 0d. and forward 10s. off at £234 15s. 0d. In lead, about 8,800 tons changed hands, both positions losing 7s. 6d. to close at £65 2s. 6d. and £66 5s. 0d. cash and three months. No more than 3,600 tons of zinc were traded, cash losing 10s. at £78 5s. 0d., and three months 15s. at £79 5s. 0d.

New York

Copper futures were steady in moderate dealings. Traders said that the Chilean labour situation was the key factor in the copper market currently. Some sources believed that a strike would develop at the Potrerillos and El Salvador mines, but whether it would turn into a general copper strike in Chile or last long enough to have an appreciable effect on copper supplies was another question. Traders expected day to day extension of the Steel Workers' Union Kennecott contract if there is no settlement today.

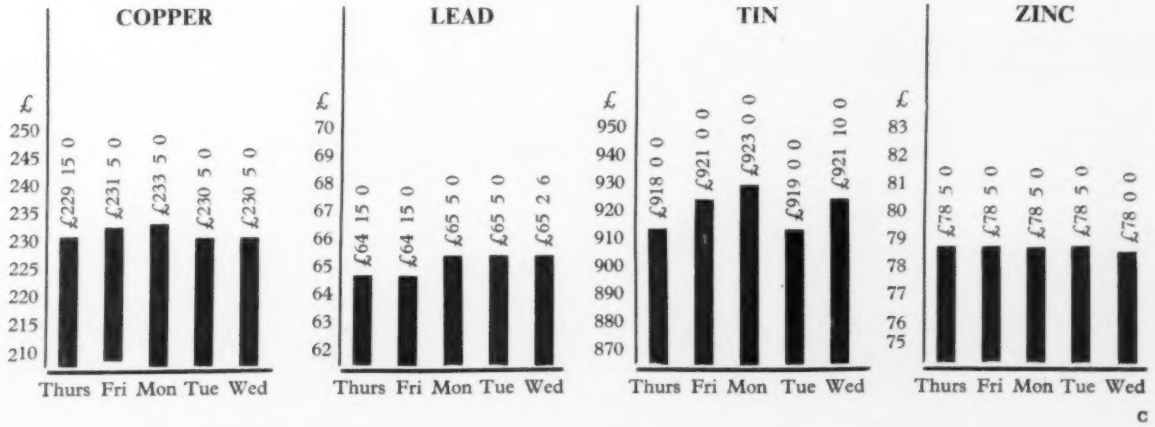
Dealers indicated that offerings were slightly above 31 cents for domestic copper, but interest was slim. Custom smelters noted fair copper sales in the domestic section, while producers indicated they were doing well with August and had not opened September order books yet. Tin was steady and quiet. Lead and zinc were moderately active.

Domestic consumption of copper by brass and wire mills and foundries, based on their shipments of fabricated products in June last totalled 123,114 short tons compared with 145,804 tons in the previous month, says the U.S. Copper Association. New business booked by fabricators in terms of refined copper to be used amounted to 122,831 short tons (146,486). Unfilled orders on fabricators' books at end-June totalled 139,585 short tons (139,868). Fabricators' stocks of refined copper at end-June were 455,784 short tons (439,198) and orders on hand with producers amounted to 99,699 short tons (103,113). Fabricators' receipts from producers were 139,700 short tons (131,317), their gross reserves 555,483 short tons (542,311), and their working stocks 359,024 short tons (361,941).

Consumption of aluminium by the U.S. can-making industry can be "reasonably expected" to increase from the 20,000 tons used in 1960 to 50,000 tons for 1961, according to the Kaiser Aluminum and Chemical Corporation. It said the increase in requirements will result partly from increased use in major outlets such as frozen fruit juices, motor oil and beer, but a substantial part will also come from the lesser known and smaller volume markets, such as food and other varied products.

London Metal Exchange

Thursday 27 July to Wednesday 2 August 1961



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NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 2/8/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	„	237	10	0
Antimony Metal 99%	„	230	0	0
Antimony Oxide Commercial	„	194	10	0
Antimony White Oxide	„	212	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		11	0
Calcium	„	2	0	0
Cerium 99%	„	15	0	0
Chromium	„		6	11
Cobalt	„		12	0
Columbite per unit			8	10	0
Copper H.C. Electro	ton	230	5	0
Fire Refined 99·70%	„	229	0	0
Fire Refined 99·50%	„	228	0	0

		£	s.	d.
Copper Sulphate	ton	78	0	0
Germanium	grm.		—	
Gold	oz.	12	12	2¼
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	65	2	6
Magnesium Ingots	lb.			
99·8%	„		2	2½
99·9+%	„		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		5	6
Alloy Ingot, AZ91X		1	11½-2	1¼
Manganese Metal	ton	280	0	0
Mercury	flask	66	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	„		5	11
Osmium	oz.	20	0	0
Osmiridium	„		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	„	30	5	0
Rhodium	„	46	0	0
Ruthenium	„	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		6	7⅞
Tellurium Sticks	lb.	2	0	0
Tin	ton	921	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	78	6	3
Dust 95/97%	„	121	10	0
Dust 98/99%	„	128	10	0
Granulated 99+%	„	103	6	3
Granulated 99·99+%	„	115	17	6

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 2/8/61

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 ton	210	0	0
B.S. 1490 L.M.6 „	202	0	0
B.S. 1490 L.M.7 „	216	0	0
B.S. 1490 L.M.8 „	203	0	0
B.S. 1490 L.M.9 „	203	0	0
B.S. 1490 L.M.10 „	221	0	0
B.S. 1490 L.M.11 „	215	0	0
B.S. 1490 L.M.12 „	223	0	0
B.S. 1490 L.M.13 „	216	0	0
B.S. 1490 L.M.14 „	224	0	0
B.S. 1490 L.M.15 „	210	0	0
B.S. 1490 L.M.16 „	206	0	0
B.S. 1490 L.M.18 „	203	0	0
B.S. 1490 L.M.22 „	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 ton	155	0	0
B.S. 1490 L.M.2 „	153	0	0
B.S. 1490 L.M.4 „	163	0	0
B.S. 1490 L.M.6 „	176	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ton	243	0	0
BSS 1400 AB.2 „	251	0	0

***Brass**	£	s.	d.
BSS 1400-B3 65/35 ton	177	0	0
BSS 249 „		—	
BSS 1400-B6 85/15 „	223	0	0
***Gunmetal**			
R.C.H. 3/4% ton „		—	
(85/5/5/5) LG2 „	219	0	0
(86/7/5/2) LG3 „	228	0	0
(88/10/2/1) „	288	0	0
(88/10/2/½) „	298	0	0
***Manganese Bronze**			
BSS 1400 HTB1 „	194	0	0
BSS 1400 HTB2 „	215	0	0
BSS 1400 HTB3 „	230	0	0
Nickel Silver			
Casting Quality 12% „	260	0	0
„ „ 16% „	270	0	0
„ „ 18% „	310	0	0
***Phosphor Bronze**			
B.S.1400P.B.1.(A.I.D. released) „	314	0	0
B.S. 1400 L.P.B.1 „	241	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ton	257	0	0
15% „	260	0	0
Phosphor Tin			
5% „	989	0	0
Silicon Bronze			
BSS 1400-SB1 „	290	0	0
Solder, soft, BSS 219			
Grade C Tinmans „	416	10	0
Grade D Plumbers „	330	10	0
Grade M „	459	0	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „ „		—	
Zinc Alloys			
BSS 1004 Alloy A ton	109	7	6
BSS 1004 Alloy B „	113	7	6
Sodium-Zinc lb.		2	6½

SCRAP METALS

Merchants' average buying prices delivered, per ton, 1/8/61

Aluminium	£
New Cuttings	138
Old Rolled	103
Segregated Turnings	78
Brass	
Cuttings	162
Rod Ends	147
Heavy Yellow	139
Light	134
Rolled	149
Collected Scrap	136
Turnings	140

Copper	£
Wire	210
Firebox, cut up	208
Heavy	207
Light	204
Cuttings	215
Turnings	190
Braziery	171
Gunmetal	
Gear Wheels	200
Admiralty	200
Commercial	182
Turnings	177

Lead	£
Scrap	54
Nickel	
Cuttings	—
Anodes	591
Phosphor Bronze	
Scrap	182
Turnings	177
Zinc	
Remelted	70
Cuttings	60
Old Zinc	40

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products

	£ s. d.
Aluminium	
Sheet 10 S.W.G. lb.	2 10½
Sheet 18 S.W.G. „	3 0½
Sheet 24 S.W.G. „	3 3½
Strip 10 S.W.G. „	2 10½
Strip 18 S.W.G. „	2 11½
Strip 24 S.W.G. „	3 1
Circles 22 S.W.G. „	3 4½
Circles 18 S.W.G. „	3 3½
Circles 12 S.W.G. „	3 2½
Plate as rolled „	2 10
Sections „	3 4
Wire 10 S.W.G. „	3 1½
Tubes 1 in. o.d. 16 S.W.G. „	4 4
Aluminium Alloys	
BS 1470. HS19W.	
Sheet 10 S.W.G. „	3 3
Sheet 18 S.W.G. „	3 5½
Sheet 24 S.W.G. „	4 1
Strip 10 S.W.G. „	3 3
Strip 18 S.W.G. „	3 4½
Strip 24 S.W.G. „	4 0½
BS1477. HP30M.	
Plate as rolled „	3 1
BS1470. HC15WP.	
Sheet 10 S.W.G. „	4 3
Sheet 18 S.W.G. „	4 8½
Sheet 24 S.W.G. „	5 8½
Strip 10 S.W.G. „	4 4
Strip 18 S.W.G. „	4 8½
Strip 24 S.W.G. „	5 4½

	£ s. d.
Aluminium Alloys—cont.	
BS1477. HPC15WP. Plate heat treated .... lb.	3 10½
BS1475. HG19W. Wire 10 S.W.G. „	4 2
BS1471. HT19WP. Tubes 1 in. o.d. 16 S.W.G. „	5 5
BS1476. HE19WP. Sections „	3 4
Split tube	
19 S.W.G. (¼″) „	4 2
20 S.W.G. (⅜″) „	3 11
21 S.W.G. (⅜″) „	4 1
22 S.W.G. (¼″) „	4 11
Welded tube 14 to 20 S.W.G. (sizes ½″ to 1½″) „	3/10½ to 5/8½
Brass	
Tubes lb.	1 10¼
Brazed Tubes „	3 3½
Drawn Strip Sections „	3 3½
Sheet ton	198 15 0
Strip „	198 15 0
Extruded Bar lb.	2 0⅜
Condenser Plate (Yellow Metal) ton	186 0 0
Condenser Plate (Naval Brass) „	199 0 0
Wire lb.	2 8½

	£ s. d.
Beryllium Copper	
Strip lb.	1 4 11
Rod „	1 1 6
Wire „	1 4 9
Copper	
Tubes lb.	2 3⅞
Sheet ton	265 5 0
Strip „	265 5 0
H.C. Wire „	283 5 0
Cupro Nickel	
Tubes 70/30 lb.	3 8⅛
Lead	
Pipes (London) ton	107 0 0
Sheet (London) „	104 15 0
Tellurium Lead „	£6 extra
Nickel Silver	
Sheet and Strip 10% lb.	3 11½
Wire 10% „	4 4½
Phosphor Bronze	
Wire „	4 2½
Titanium (1,000 lb. lots)	
Billet 4½″ to 18″ dia. lb.	47/- 48/-
Rod ½″ to 4″ dia. „	85/- 53/-
Wire ·036″-232″ dia. „	159/- 99/-
Strip ·001″ to ·048″ „	350/- 68/-
Sheet 8′ × 2′. 20 gauge „	73/-
Tube, representative average gauge „	198/-
Extrusions „	90/-
Zinc	
Sheet ton	116 0 0
Strip „	nom.

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium	fr/kg	£/ton
Copper: electrolytic	31.75	232 1
Tin	128.10	936 5

Canada	c/lb	£/ton
Aluminium	26.00	210 12
Copper: electrolytic	30.00	243 0
Lead	10.50	81 0
Nickel	70.00	567 0
Zinc: Prime western	12.00	97 4
High grade 99.95	12.60	102 1
High grade 99.99	13.00	105 6

France	fr/kg	£/ton
Aluminium	2.43	179 11
Antimony 99·0	2.80	206 18
Cadmium	16.35	1,208 5
Copper: electrolytic	3.19	235 14
Lead	.95	70 4
Nickel	9.00	665 2
Tin	13.05	964 7½
Zinc: Thermic	1.14	84 4
Zinc: electrolytic	1.22	90 3
Scrap		
Copper: electrolytic	2.85	210 12
Heavy copper	2.85	210 12
No. 1 copper wire	2.70	199 10
Brass rod ends	2.10	155 3
Zinc castings	.90	66 10
Lead	.87	64 5
Aluminium	1.75	129 6

Italy	lire/kg	£/ton
Aluminium	370	216 1
Antimony 99·0	485	283 4
Copper: wire bars 99.9	450	262 16
Lead	164	96 15
Nickel	1,300	805 14
Tin	1,750	1,022 0
Zinc: electrolytic	180	105 2
Scrap		
Aluminium soft sheet clippings (new)	305	178 2
Lead, soft, first quality	137	80 0
Lead, battery plates	77	45 19
Copper, first grade	375	219 0
Bronze, commercial gunmetal	410	239 8
Brass: heavy	275	160 12
Brass: light	260	152 16
Brass, bar turnings	275	160 12
Old zinc	105	61 6

Switzerland	fr/kg	£/ton
Aluminium	2.50	210 5
Copper: electrolytic	2.88	242 4
Lead	.82	68 19
Nickel	7.50	630 15
Tin	11.25	946 2
Zinc: High grade 99.99	1.06	89 2

Japan	Yen per metric ton
Scrap	
Copper: electrolytic	298,000
Copper wire No. 1	272,000
Copper wire No. 2	268,000
Heavy copper	262,000
Light copper	237,000
Brass, new cuttings	203,000
Red brass scrap	215,000

West Germany *Scrap*	D-marks per 100 kilos	£/ton
Used copper wire	225	205 0
Heavy copper	220	200 8
Light copper	190	173 1
Heavy brass	145	132 1
Light brass	110	100 5
Soft lead	50	45 11
Zinc	50	45 11
Used aluminium unsorted	75	68 6

United States	c/lb	£/ton
Aluminium	26.00	207 4
Antimony 99·0	32.50	259 0
Cadmium	160.00	1,275 4
Copper: electrolytic	31.00	247 10
Lead	11.00	87 13
Nickel	81.25	647 11
Tin	117.00	932 10
Zinc: electrolytic	12.50	99 12

THE STOCK EXCHANGE

Markets quiet and uncertain

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 31 JULY +RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	31/— —1/—	11	9	7 1 9	33/9	26/3	35/—	26/6
400,000	2/—	Anti-Attrition Metal	1/3	NIL	4	NIL	1/3⅜	0/9	1/6	0/9
43,133,593	Stk. (£1)	Associated Electrical Industries ...	35/9 —2/9	15	15	8 7 9	54/10½	36/6	67/3	38/3
3,895,963	1	Birfield	62/— +1/6	10	15‡	3 4 3	78/9	45/—	51/3	29/—
4,795,000	1	Birmid Industries	75/— —1/6	20	20D	5 6 9	103/—	71/3	74/9	56/—
8,445,516	Stk (10/—)	Birmingham Small Arms	21/— —2/—	17½QT	12½	5 11 3	36/10½	20/6	30/6	18/3
203,150	Stk (£1)	Ditto Cum. A. Pref. 5%	14/—	5	5	7 2 9	14/6	13/1½	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/6	6	6	7 5 6	17/6	16/1½	20/—	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	15/9	6	6	7 12 6	18/—	15/3	21/1½	17/7½
18,846,647	Stk. (£1)	British Insulated Callender's Cables	55/6 —1/6	13½	13½	4 17 3	62/3	49/—	61/4½	47/—
20,456,599	5/—	British Oxygen Co. Ltd., Ord. ...	19/6 —1/6	16D	16	2 14 9	28/4½	17/6	35/—	19/10½
1,200,000	Stk. (5/—)	Canning (W.) & Co.	15/6 —6d.	15⅝	25+*2½C‡	5 0 0	20/9	13/7½	19/9	13/7½
60,484	1/—	Carr (Chas.)	1/— —1½d.	NIL	12½	—	1/7½	10½d.	2/3	1/—
555,000	1	Clifford (Chas.) Ltd.	30/— —1/—	12	10	8 0 0	31/—	26/—	35/—	28/9
45,000	1	Ditto Cum. Pref. 6%	15/—	6	6	8 0 0	15/3	15/—	16/—	15/10½
300,000	2/—	Coley Metals	3/3	15	15	9 4 6	4/5½	3/—	5/—	3/4½
10,185,696	1	Cons. Zinc Corp.†	69/9 +4/—	20	15	5 16 6	81/6	63/—	80/9	59/6
5,399,056	1	Davy-Ashmore	142/6 +2/6	27½	22½	3 17 3	177/6	129/6	147/3	99/6
8,000,000	5/—	Delta Metal	21/— —1/9	20	17½	4 15 3	27/7½	19/9	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	40/6 +1/—	15	15	7 8 3	52/3	39/—	56/9	45/—
1,155,000	1	Evered & Co.	44/—	10	10φB	4 11 0	45/9	42/6	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	29/6 —1/3	10	10	6 15 6	39/6	29/—	47/9	29/—
1,500,000	Stk. (10/—)	General Refractories Ltd.	55/— —2/—	25	20	4 11 0	65/—	42/9	52/6	40/—
937,500	5/—	Glacier Metal Co. Ltd.	18/— —3d.	15	13	4 3 0	21/1½	13/9	16/1½	11/1½
2,500,000	5/—	Glynwed Tubes	24/6 +3d.	22½	25¶	4 11 9	30/3	23/—	27/6	17/—
7,228,065	10/—	Goodlass Wall & Lead Industries ...	33/3 —1/3	15	19L	4 10 3	44/9	32/6	41/9	33/—
696,780	10/—	Greenwood & Batley	20/— —6d.	15	30‡	7 10 0	29/6	20/6	33/6	29/1½
792,000	5/—	Harrison (B'ham) Ord.	10/6 —3d.	*10	*20‡	4 15 3	14/6	10/9	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	19/9	7	7	7 1 9	20/4½	19/7½	23/6	22/—
1,612,750	5/—	Heenan Group	12/3 —3d.	13	15	5 6 0	17/1½	10/6	13/—	9/10½
251,689,407	Stk. (£1)	Imperial Chemical Industries ...	68/—	13⅜	11½	4 0 9	81/6	63/1½	76/6	54/—
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	14/1½	5	5	7 1 6	16/—	13/10½	18/—	15/4½
29,196,118	••	International Nickel	155 +1½	$1.60	$1.50	1 15 6	155½	104	105	84⅜
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	14/—	5	5	7 2 9	14/10½	13/6	16/6	14/6
6,000,000	1	Ditto Ord.	71/—	15	12	4 4 6	75/—	57/6	67/6	44/9
600,000	10/—	Keith, Blackman	18/6 —6d.	17½	17½E	9 9 3	21/6	17/6	32/6	17/6
320,000	4/—	London Aluminium	12/3	13	12	4 5 0	15/—	8/6	12/6	7/10½
765,012	1	McKechnie Bros. Ord.	40/6xcap	12½K	17½F	6 3 6	53/6	35/4	71/6	57/3
1,530,024	1	Ditto A. Ord.	37/3xcap	12½K	17½F	6 14 3	53/3	35/3	69/3	55/—
1,168,268	5/—	Manganese Bronze & Brass	13/6	20⅝	20⅝	7 14 3	18/6	13/—	18/6	13/4½
50,628	6/—	Ditto (7½% N.C. Pref.)	5/6	7½	7½	8 3 6	6/—	5/—	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	85/— —4/—	12	12M	2 16 6	100/9	68/3	84/3	61/—
415,760	Stk. (2/—)	Metal Traders	7/6 —3d.	50	50	13 6 9	8/9	6/9	10/9	7/1½
160,000	1	Mint (The) Birmingham	34/—G	15	12½	5 17 9	35/9	24/—	39/—	33/6
80,000	5	Ditto Pref. 6%	72/— —4/3	6	6	8 6 9	77/6	72/—	80/—	75/—
5,187,938	Stk. (£1)	Morgan Crucible A	56/— +9d.	14	13	5 0 0	71/3	53/4½	63/—	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	14/6	5½	5½	7 11 9	17/—	14/1½	18/9	15/9
3,850,000	Stk. (£1)	Murex	41/— —6d.	13	22½J	6 6 9	52/—	39/9	45/—	35/3
585,000	5/—	Ratcliffs (Grear Bridge) Ord. ...	16/3	10	10R	3 1 6	16/6	15/9	17/—	14/9
195,000	5/—	Ditto 8% Max. Ord.	5/—	8	—	8 0 0	5/1½	4/9	5/3	5/—
1,064,880	10/—	Sanderson Kayser	31/—	17½	35‡	5 13 0	41/3	30/—	40/3	27/7½
3,400,500	Stk. (5/—)	Serck	15/3 —3d.	12½	17½GD	4 2 0	19/3	14/9	25/6	15/3
8,035,372	Stk. (£1)	Stone-Platt Industries	50/6	16	15	6 6 9	67/—	50/—	64/4½	52/3
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	13/9	5½	5½	8 0 0	18/—	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	66/3 —2/9	14	20	4 4 6	85/6	66/3	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	32/6 —9d.	10	10	6 3 0	38/3	28/—	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref 5%	14/—	5	5	7 2 9	15/—	12/7½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	18/9	*5	*5	7 18 9A	21/1½	18/3	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord.	69/—	13⅜	25	3 19 9	84/6	64/6	94/—	63/—
7,109,424	Stk. (£1)	Westinghouse Brake	33/6 —1/3	11	10	6 11 3	46/3	33/6	60/6	37/6
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156,930	2/6	Wright, Bindley & Gell	4/3	15	20‡	8 16 6	4/9	3/7½	4/6	2/10½
124,140	1	Ditto Cum. Pref. 6%	13/—	6	6	9 4 6	13/7½	13/—	15/—	13/6
150,000	1/—	Zinc Alloy Rust Proof	4/6	40	30	8 17 9	5/6	4/6	5/4½	4/—

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡and 100% capitalized issue. • The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. φ and 6½% from Capital Profits. B and 50% capitalized issue G And 50% capitalized issue. F and special 5% tax free dividend and 50% Capitalized issue. H As forecast. ¶And 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. S and 40% capitalized issue. O calculated at 13⅜%. Interim on smaller capital. P calculated at 11½% Q also 1/- special tax free dividend and 50% capitalized issue T Per £1 unit. Z After capital reorganization. The Thomas Bolton Capital has been acquired by British Insulated Callender's Cables. K Forecast dividend.

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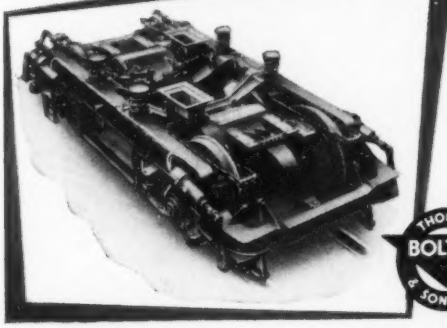

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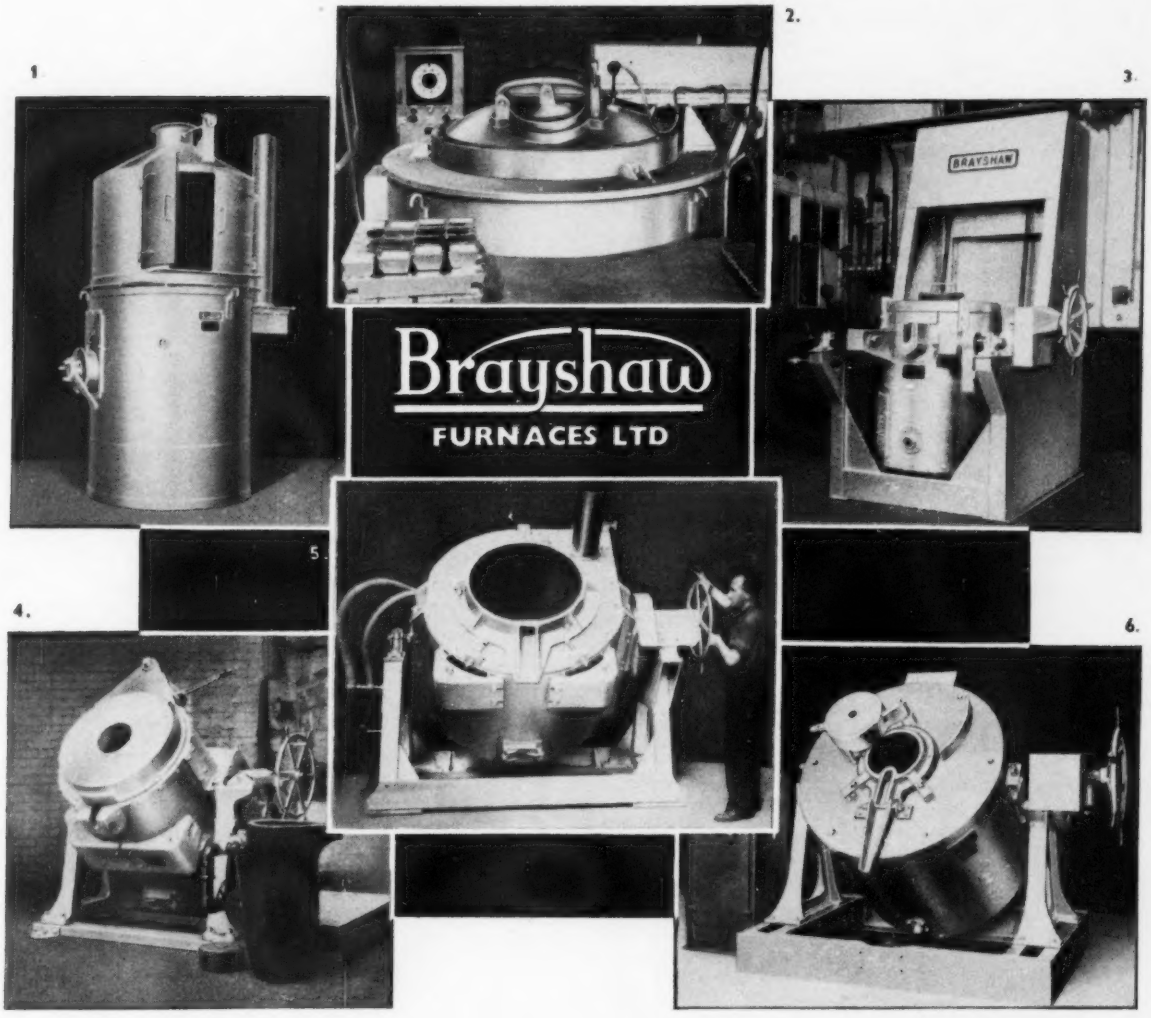

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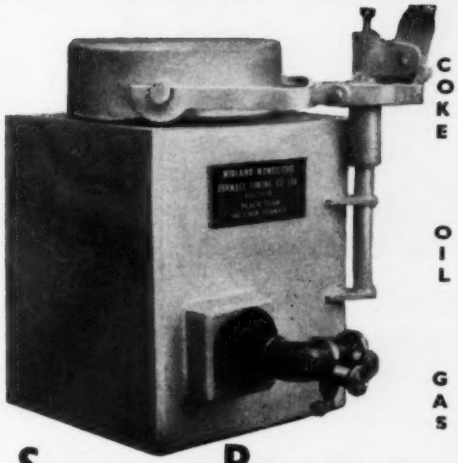

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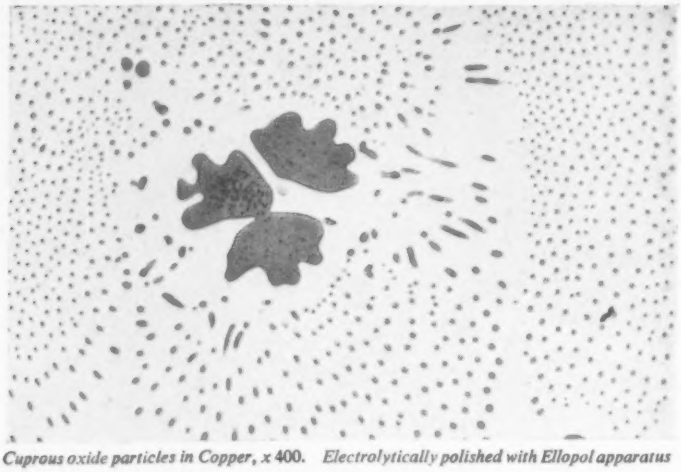

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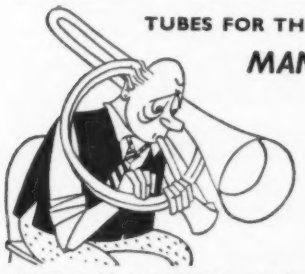

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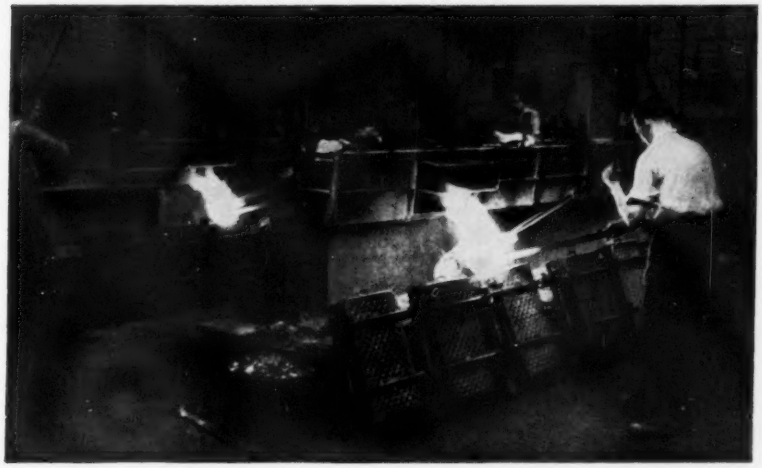

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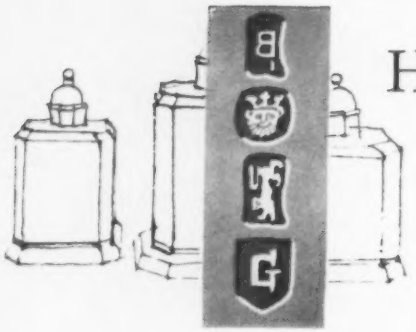

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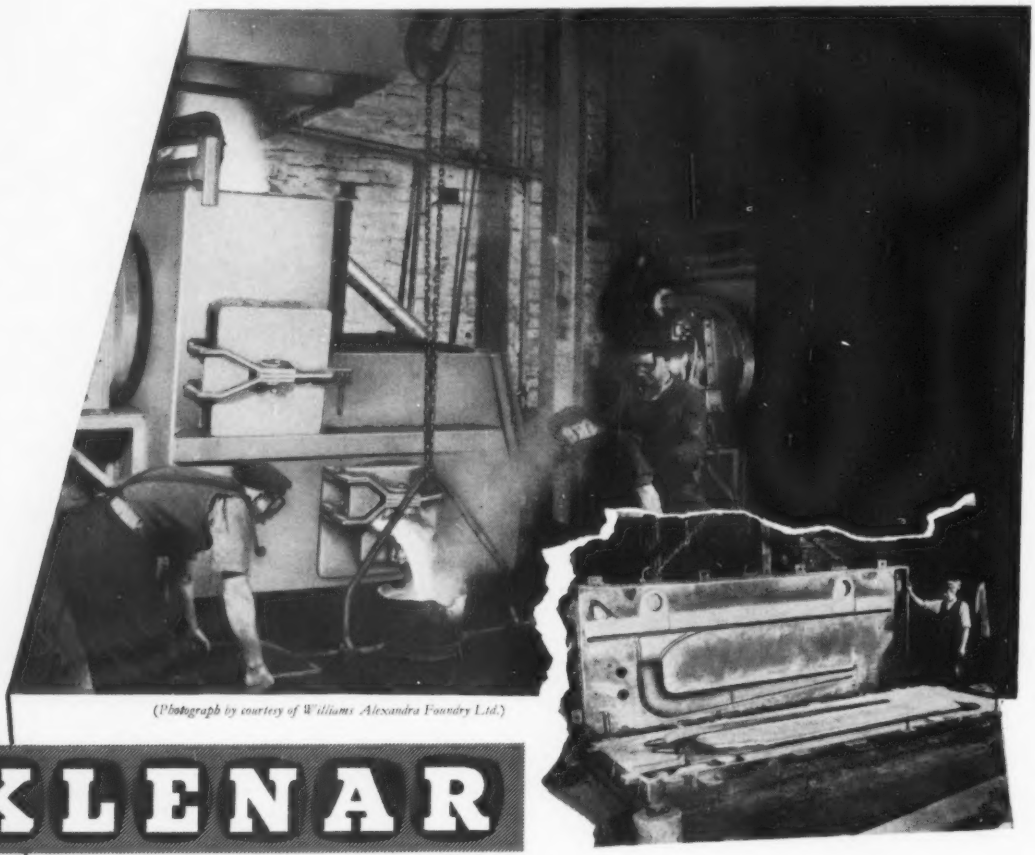

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